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University Education and Citizenship

Probably the greatest stimulus that Australia has ever received in the need for reform of its educational systems, has resulted from the recent congress of the New Education Fellowship, sessions of which were held in all capital cities. The strong personnel of the visiting delegation included leading educators from several countries, and the attack which many of them made on the weaknesses and shortcomings of our systems in Australia was rendered more impressive in the light of the success which has attended their efforts at implementing the new principles in their own lands. The delegates were representatives of countries where great concern is being felt at the growing deterioration in international relations, the grim menace of rearmament and the power of State Absolutism. True democracy, to them, was the only state of society which offered the solution to world problems, and to that end the New Education Fellowship avers that only by directing all systems of education

with complete citizenship as the final goal, can satisfactory progress be made towards attaining the desired state and in achieving international harmony. The message is not a new one, but the tangled skein of world developments in recent years most surely calls for a readiness on the part of all in authority to show some active response to the claims of these thinkers and leaders from the older countries.

The discoveries of science in the last twenty years have effected tremendous changes in society, and society will continue to change. The manner in which the results of scientific inquiry have in certain instances been prostituted to unworthy ends is indeed a matter for regret ; but it is still more regrettable that the scientist usually is uninterested in the social consequences of his work, and is apt to display little practical concern for the final outcome of his discoveries. The teaching of science, and indeed most subjects, at our schools and universities has been more in the nature of an aid to a vocation, rather than as part of a general scheme of training which aims at producing men and women who have not only specialised knowledge but also an introductory acquaintance, at least, with those subjects which would enable them more effectively to take their place as world citizens. Only when—and the process must surely be a gradual one—there is developed in every member of the community a consciousness of his or her responsibility towards one another and towards the various groups that constitute a community, can our educational systems be said to be functioning satisfactorily. Education for life was the keynote of most of the addresses delivered by visiting delegates to the Fellowship Congress, and while the remarks centred largely upon the public school curricula, they were applicable in very many respects to those of the higher centres of learning.

To what extent are the Australian universities taking account of the doctrines of the New Education, doctrines which have been preached for the last fifteen years or so ? The tendency in the university science and agricultural science curricula in the past decade has been to encourage more and more the spirit of research and specialisation during the undergraduate years. The aim presumably is to provide some little training in research methods in a selected subject, and to render the graduand seeking a post in a specialised field more fit for immediate prosecution of the tasks before him. The aim is a laudable one when viewed from one particular angle. The present age is one of specialism, and needs the specialist workers. But when one takes stock, on the one hand, of advances made in the past by those who in their university days knew no system other than the one of broad general training, and, on the other hand, of the small degree of benefit accruing from the present scheme, it may be asked in all respect whether the universities are actually fulfilling their proper functions in relation to the community life—whether the tendency

is not more to *train* than to *educate*. The annual degree-conferring ceremony is frequently one in which the principal speaker alludes in broad generalities to the spirit of citizenship and the need of university men with leadership for the problems of society. There the matter appears to begin and end. In a changing world the educational systems need to be more realistic than academic, but they should also be adapted so as to provide and encourage study in those subjects not strictly necessary for professional efficiency (such as modern industrial and political problems, religion, administration, social science), subjects which lead to a keener appreciation of the importance of world problems, to a realization of the need for a richer and fuller discharge of the responsibilities of citizenship, and hence a greater readiness to help in dealing with a complex society.

The Estimation of Agricultural Potentialities

By

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President of the Institute.

THE NEED.

Although the spruiker of unbounded potentialities is at present quiescent he is by no means dead, and the first need for an estimation of agricultural potentialities is to frame a reliable basis for estimating the capacity of the country for various forms of production. Land settlement schemes of the past were developed mainly from the point of view of disposing of land, and took too little cognizance of the economic background behind the rural industries concerned, and sometimes too optimistic a view of the productivity of the soils. Badly conceived schemes of settlement or subdivision almost invariably lead to a wastage of capital. Every agricultural failure, whether of a State-conducted enterprise or of an individual, leads to a loss of national wealth. In the former case the whole nation shares the burden through taxation, in the latter only the creditors are immediately concerned, but through them the whole economic structure is ultimately affected.

Faulty methods of land usage may result in soil deterioration and erosion. These ultimately lead to a wastage of capital and, more important, to the destruction of one of the nation's main assets—the fertility of its countryside.

Further, a land utilization survey should also lead to constructive thought. No intelligent agriculturalist can imagine that the present Australian systems of land usage are final. " Extensive " methods of farming still hold sway in

many regions where " intensive " methods would lead to better results. Moreover, it seems certain that new methods may be expected to develop in the future and that some will be of value to Australian agriculture. An estimation of what might be, and its comparison with what is, should surely prove a valuable stimulus to the scientific investigation of farming practice.

Finally, it is high time the world outside was given a little more information about the true potentialities of rural Australia. At present, the dry bones of statistics, the utterances of interested parties—be they disgruntled migrants or aspiring statesmen—or the accounts of travellers who usually make a rubber-necking tour with the idea of writing up a commercial volume, are almost the sole sources of information on Australian agriculture available to the outside world.

METHODS.

There are two distinct methods of approaching the problem of land utilization. The historical approach surveys the lines of advance which have been made and endeavours to assess the various factors which have operated in bringing the present state of affairs into being. It should indicate why progress has been slow here and rapid there, it throws into high relief the obstacles which have been overcome in each district or each industry, and it makes a surmise or an analysis of the barriers which now lie in the path of progress. If it includes an economic survey, it should show the probable effect on the countryside of changes in the market value of commodities. The alternative method of approach is the more direct one of first attempting an analysis of the climatic and soil conditions prevailing in each district. Then if such data are used in conjunction with facts concerning the present use to which land is put when in good hands, it becomes practicable to estimate in a broad way the potentiality of each area of the country as a whole.

Either method of approach leads to the same end point. On the whole, the historical approach tends to be more conservative because it makes the student particularly alive to the obstacles of progress whether they are technical, economic or sociological. The approach through the study of the natural equipment of the country tends to lay stress on things as they might be, and is, therefore, unduly optimistic for a practical world. It may break down badly unless the workers have a proper appreciation of the importance of soil differences within a climatic district.

A student used to the former method of thought and interested in the industry of producing rice or fat lambs, would be impressed by the way in which these forms of production had expanded. In the case of rice he would discover that the expansion of acreage under the crop is practically, though indirectly, controlled through a limitation on water for irrigation. In the case of fat lambs he would be particularly aware of the limit which has been

placed on indefinite expansion of production owing to the virtual restriction of markets to Britain and the potential quota in that market. On the other hand, a student approaching the subject along the other path would study the area in which rice could be grown and fat lambs could be raised, and would be impressed by the great opportunities of expanding either form of production. He would presumably, sooner or later, learn of the restrictions in the quota and amend his estimate accordingly. The final result would be the same in each case provided the student was sufficiently unbiased to give due weight to each factor. The best result would probably be obtained if the student with the idealistic mind used the first method, while the one with a conservative temperament used the second.

In a workaday world where planning on a logical basis is rare and temporizations are the rule of the day, we have to face the fact that the ideal is unattainable. Nevertheless, estimations on an ideal basis are both interesting and instructive. As long as they remain in the hands of sane individuals who understand their limitations, they are valuable because they tend to focus attention on the barriers to progress which may, as a result, be removed in due course. But in the hands of opportunists, they are definitely dangerous because such persons are always prepared to accept a generalization and ignore the qualifications with which such a generalization must necessarily be surrounded. It is, therefore, imperative that if a scientific body is to set out on a survey of land utilization, it must state in the clearest possible terms the qualifications which limit the application of its results. There are too many instances of cases where scientific statements have been put to purposes for which they were never intended, and have been made to reflect discredit on those who originally propounded them, quite irrespective of the fact that such discredit may have been totally unmerited.

SURVEYS IN OTHER COUNTRIES.

It is of some interest to mention briefly the efforts which have been made in various places to conduct land utilization surveys. In the crowded European countries, particularly Germany, great attention has been given to this kind of work, but the problems involved, although complex, are of a somewhat different order from those which apply in Australia. In the U.S.A., where there are still large areas of land in the primary exploitative phase, great attention has been devoted to the matter in recent years. There have been numerous surveys of small areas but probably the best compound work is that comprised in the "Map of Natural Land Use Areas", published in 1933. This is based on the results of soil surveys, together with topographic and climatic knowledge and, above all, experience. In this survey the country is divided into 272 agricultural areas, each with its own character. These are grouped into 24 types which are further assigned to two classes. The distinction

between classes depends on whether a type has little or much land, the best use of which is problematical. It is to be noted that value from a productive point of view plays no part in the compilation of the two classes. Deserts and mountain areas are alike put into the class containing types for which there is no doubt as to the best use ! !

WORK IN AUSTRALIA.

I believe we, in Australia, could construct a similar map for the Commonwealth. We should probably find it necessary to deal lightly with the subdivision of the inner grazing areas and to amplify the subdivision of the coastal regions. There is a fair amount of generalized and some detailed data available for most of the States. We have Prescott's invaluable survey of soils and vegetation. Teakle's recent contribution to the A.N.Z.A.A.S. with regard to Western Australia is a definite advance. Davidson's work at the Waite Institute on climatic zones as affecting insect ecology is pertinent. Trumble, working along similar lines, from the plant standpoint, and adding a consideration of soil types, has subdivided South Australia into edapho-climatic zones, making an estimate of the form of land utilization most suited to each.* In the other States numerous papers have been published on small areas, but general descriptive surveys have been lacking.

It seems probable that each branch of the Institute of Agricultural Science could begin to carry out the suggestion put forward by Professor Richardson in his presidential address by enlisting the interest of its members in constructing a map of the agricultural regions of the particular State in which it is located.† This would involve a pooling of knowledge of the soils in the various districts, coupled with an examination of the climatic data and a knowledge of crop requirements. At the same time a survey of the statistical records would give clear indications of the present use to which the land is being put. Surveys of the latter kind have already been carried out by the School of Geography in the University of Sydney, and a study of Victoria from the same standpoint is approaching the stage of publication.

Investigations of this kind when carried out by competent agricultural observers are both informative and valuable. Difficulties begin to arise when the question of deciding how far each given individual industry may be expected to expand, is considered. The agricultural history of every country, Australia included, is littered with the wrecks of bygone agricultural systems which have been discarded as a result of scientific development or economic pressure. The trouble, of course, lies in the fact that one can often

* Trumble, H. C. (1937) : " Climate Control of Agriculture in South Australia." Trans. Roy. Soc. South Australia 61 : 41–62.

† It is suggested that the Canberra Branch might tackle the Northern Territory, as this Branch has easy access to the Department of the Interior, which is the best source of information on the subject.

do so many different things with land provided the returns warrant the necessary expenditure. We ought to be in a better position than anyone else to decide what improvements in agricultural technique are likely to appear in the next decade, but the evaluation of the economic factors is more difficult. The question of the price which is likely to be realized for any given commodity must largely determine the range of country over which it is to be produced. In Victoria, we have learnt that certain sections of the Northern Mallee, although potential wheat areas, are not effective regions for the growth of this crop because the price received is normally insufficient to recompense the grower for the relatively small yield which he obtains in the average season. The only way in which a district can take on a new form of production which previously was uneconomic is by learning some new method which will enable it to lower its costs per unit of production. Having regard to these facts, it is necessary to stipulate that no form of production shall be postulated for an area unless such production can be carried out with a margin of profit and at a reasonable average price. The question of reasonable average price is, of course, debatable, but it seems probable that 3/– per bushel at sidings for wheat, 1/– per pound for butter fat and 10/– per head for a mid-season fat lamb are prices which may be conveniently adopted.

The question of export markets and their effect on price comes into the picture, but any attempt to estimate the future export consumptive demand for Australian agricultural products would be so hedged round with qualifications as to be virtually valueless. All we can do is to indicate mean price levels about which the world price seems to fluctuate, and remember that we have made a definite proviso in building any superstructure on our estimates.

THE QUESTION OF NUMBER OF FARMERS.

A concentration of all the available knowledge would yield for each division of each State an approximate statement indicating the area of land which could be effectively employed for each type of land usage (e.g. wheat growing, wheat and sheep farming, dairying, cattle raising, wool production, fat lamb raising, fruit growing, etc.), it being understood that the best practices were used in each case in so far as they were economically sound.

The average productivity of each type in each district can usually be estimated. From this figure the acreage which is normally associated with each man labour unit can be determined if due regard is given to special features of the district. From man labour units the prospective agricultural population can be estimated. It is probably safer to work in units of labour rather than in size of farms, because although the Australian ideal seems to be the one-man farm, in practice such units are often inefficient and unstable. Further, it is doubtful whether our average agricultural population is likely to contain

a sufficient number of farmers with the skill and knowledge necessary to manage the farms on an intensive basis.

The final estimation of rural population employed in production from the land is obviously compounded by superimposing many estimates on one another, and is therefore highly problematical. It presupposes that markets can be found for the extra production at the price levels taken. It assumes that all the land will be used efficiently for the type of farming to which it is allocated. It suggests that all farmers manage their properties efficiently, and that the capital required for equipping the farms for the new type of production is available. All of which factors are beyond scientific control. In addition, it presupposes that the members of the Institute who provide the basal knowledge of the potentiality of each district have done their job efficiently—as I have little doubt they will if they can spare the time for the work.

A SUGGESTION.

My own view is that the branches of the Institute should start by preparing land use maps of their various parts of the Commonwealth on the basis of an efficient standard of farming, such maps being accompanied by notes of the type of farming considered most effective for each area. The first step would be a tentative list of the various types of land usage which would be recognized by each branch. A central committee could arrange for the correlation of types common to various States. At the same time, branches could prepare diagrams of their States by statistical districts showing a three-year average production. All this material could be published and would be immensely valuable in various ways. Branches could then go on to consider the population problem in due course, but in view of the numerous factors which can only be estimated somewhat roughly it might be as well to confine the population aspect of the enquiry to discussions at private gatherings.

Many members of the Institute will be aware that Dr. Gordon Wood and I have been engaged on a land utilization survey of a broad type for some years. If the branches of the Institute should so desire, the results of their work could be embodied in the volume, due acknowledgment being given to the source of the material.

The Present Position in Blowfly Control in New South Wales

WITH SPECIAL REFERENCE TO THE PROBLEMS ASSOCIATED WITH JETTING

By

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The value at any moment of progress being made in a complex problem such as that presented by blowfly attack on sheep must in some degree be a matter of opinion. The value of any one method of control can only be assessed by a comparison of it with other methods or combination of methods.

The writer, who has been engaged for six years in work dealing with the protection of sheep by jetting, considers the present an appropriate time for the summarising of his views on the control of blowfly attack in New South Wales, and on the form which future research on jetting should take.

Important recommendations which have been made for the removal or reduction of costs of blowfly control may be considered as :

(*a*) Measures aiming at reducing the fly population.
(*b*) Measures aiming at protecting sheep from infestation.

(*a*) MEASURES AIMING AT REDUCING THE FLY POPULATION.

At present it seems unlikely that the " solution of the blowfly problem " will be arrived at by reducing the numbers of flies.

(1) No parasitic insect has as yet proved to be even a moderately important influence. Nowhere in the world are blowflies kept down in numbers by parasites. English and Australian (C.S.I.R.) workers have shown that competition for food among blowfly larvæ themselves is by far the most important factor in keeping the fly population at its present level,[6] [17] and have concluded that little prospect of satisfactory biological control exists.[8] [9]

(2) Carcase destruction is virtually out of the question. Unless one has had to search a given area for sheep carcases known to be present, it is hard to realize how difficult they are to find, even in lightly timbered, sheep-to-the-acre country. In " bad fly districts ", areas are usually fairly large and frequently a good deal of scrub obstructs the view. Further, the destruction of all sheep carcases immediately after death would not abolish blowflies, which are abundant on the highlands and the coast even where sheep are rare. Probably the bodies of rabbits, birds, reptiles, etc. (usually ignored when

carcase destruction is advocated) could maintain a blowfly population sufficient to infest all susceptible sheep. It has been shown by C.S.I.R. workers that a struck sheep will normally produce many more *Lucilia cuprina* than will a sheep carcase.[9]

(3) The trapping and poisoning of adult flies have never been shown to give economical control. C.S.I.R. workers consider trapping to be better that poisoning.[9]

The young sheep at Walhallow Station in the spring of 1930 experienced a very severe " wave " of strike while grazing in paddocks having ten well cared-for traps for 2,000 acres. For the same period four traps about a killing shed failed to prevent heavy infestation of fresh skins by *Lucilia cuprina*.

Recent experiments[11] showed an average reduction of strike in trapped paddocks of rather more than 50 per cent., as compared with those in untrapped paddocks, the trap concentration being as high as one per eighteen acres. Where this concentration was employed, strikes dressed reached 10 per cent. of the sheep in four months, as against 20 per cent. in the untrapped paddock. In sheep-to-the-acre country the cost of installing such numbers of traps would be at least 6d. per sheep ; their maintenance would probably cost more than 6d. per head per annum. For lighter-carrying country, these figures would be larger. The return from this expenditure would be a reduction in, not freedom from, strike.

Unless traps and baits can be greatly improved, trapping would appear to be uneconomical. Such an improvement is possible, and is being sought after,[9] but could not be described as probable. Trapping must be said to be the reverse of promising.

(*b*) MEASURES AIMING AT PROTECTING SHEEP FROM INFESTATION.

Under the heading of measures aiming at protecting the sheep may be considered :

(1) The maintenance of health in sheep.
(2) Breeding for insusceptibility.
(3) The Mules fold-removal operation.
(4) Hand dressing.
(5) Crutching.
(6) Jetting.

Maintenance of Health in Sheep.

The avoiding of fly losses by the maintenance of health in sheep is referred to here because of the comparative frequency with which it is advocated in journals with a rural circulation. The notoriously heavy strike on stud properties where sheep have more grazing room, more attention, and in general

better conditions than can be provided for " flocks ", would indicate that the maintenance of health alone certainly does not lead to blowfly control.

The idea has been considered and rejected by veterinarians who could find no evidence of ill-health in recently-struck sheep.[2] [18]

Breeding for Insusceptibility.

Doubts as to the importance of breech wrinkles in determining susceptibility to strike were cleared up in 1931.[18] Many stud masters maintain that to breed consistently for insusceptibility must lead to lower returns for wool, but it has been shown repeatedly that insusceptible and susceptible ewes from stud flocks return equal clips.[2] [3] [4] [5] Many buyers are now demanding rams with plain crutches, and the movement away from " breech development " is probably accelerating. But it must be many years before merinos with quite plain crutches are the rule, and meanwhile the industry needs cheaper protection for existing flocks.

The Mules Fold-Removal Operation.

By the Mules operation it is undoubtedly possible to reduce susceptibility. At the Nyngan Experiment Farm a reduction in strikes in the first year of more than 66 per cent., and in the second year of more than 50 per cent. followed the treatment of half of one season's drop of ewe lambs.[19]

At Noondoo, in southern Queensland, the treatment of one-half of 13,700 ewe lambs at marking was followed at crutching (10 months later) by their showing 20 per cent. of strikes, as compared with 25 per cent. in the untreated half of the flock.[10]

Further evidence is required as to what reduction in strikes may be expected to follow the treatment under varying conditions, and particularly as to the return from one or more re-treatments as advocated by Mules.[16]

It has not been shown, and in the writer's opinion is unlikely to be shown, that susceptibility can be reduced by breeding or by surgery to the point where repeated crutching and/or jetting (as required for present flocks) is unnecessary if constant handling is to be avoided.

The chief value in eliminating crutch wrinkles may prove to be an extension in the time of protection afforded by crutching or jetting.

Hand Dressing.

There is a constant demand by graziers for a better dressing than is available at present—one which will prevent restrike under all conditions. Actually, should such a dressing be obtained, the pastoralist will be little better off than he is now. Ordinary useful dressings, such as a solution of copper sulphate, are followed by negligible restrikes except in bad fly " waves ". If one set out to manage a flock, for instance during a humid autumn at

Gulargambone, by hand dressing, even if every sheep dressed were immunised for a month, new strikes would be appearing so rapidly as to make constant mustering essential. In young ewes crutched at the end of February, 50 per cent. of dressings during the autumn would be a high but not an unusual figure. Of these, not more than one-quarter would be restrikes, if copper sulphate were used. Therefore, with the perfect dressing, 37 per cent. of treatments would be needed—very much more expensive in sheep, wool and labour than repeated crutching or jetting.

It is certain that under a policy of repeated dressings badly damaged fleeces and deaths from strike occur. Their numbers vary with the efficiency of management and size of paddocks and flocks. They are almost certainly more numerous than is generally admitted.

Crutching.

Crutching is an excellent practice. One mid-season treatment has certain value, in addition to the immediate protection it confers ; it prevents the existence of excessively dirty wool at shearing ; and, in addition, at the Trangie Experiment Farm it has made an autumn jetting more effective than a jetting done on eight months' wool.

Although some graziers maintain that jetting gives better protection against strike, in the writer's experiments during the past four years crutching, when applied right at the outset of a " fly wave ", has never failed to be better than the best jetting,[12] [13] [14] [15] giving six weeks of almost complete protection under conditions favourable to " strike ". This indicates that three or four crutchings in the year, applied in anticipation of, or at the onset of any fly activity, would reduce strikes in our " worst fly districts " to an almost negligible figure. There are, however, certain important disadvantages associated with such a programme of repeated crutchings, namely :

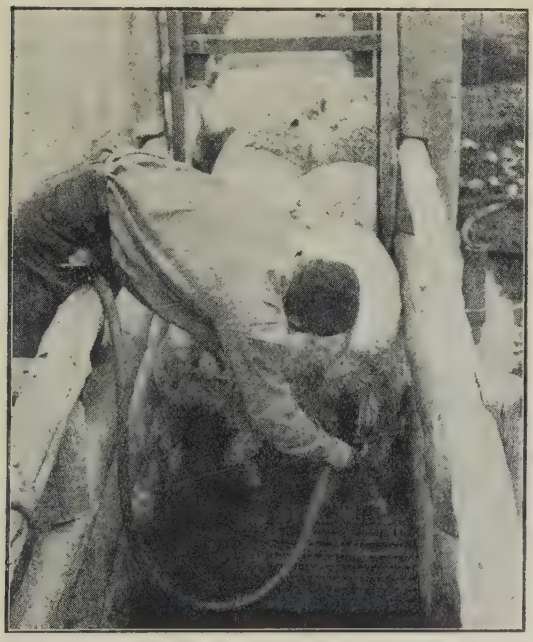
(*a*) The actual cost, close to 1½d. per head per treatment.
(*b*) The cost in shortening the staple of crutchings. This, according to work at the Trangie Experiment Farm, would amount to almost 3d. per head in the year.[14] [15]
(*c*) Crutching for large flocks cannot always be embarked on at short notice, so that the last lots through the shed may already show heavy infestation.
(*d*) Crutching will not, if conditions favour strike, carry ewes through the normal lambing period.

Jetting.

Jetting, if wholesale treatment is to be applied whenever the flocks need it, has certain advantages over crutching. It costs, for material, about ¼d. per head per treatment, and it can be brought into action at the shortest notice when strike appears, by the normal station employees. If labour is valued at 10/– per man per day, labour costs will be ¼d. per head. Calcium arsenite, to which the price quoted applies, is one of the cheapest as well as

the most protective mixture at present available. It seems unlikely that a more efficient one will be discovered in the near future.

One jetting with calcium arsenite under conditions favourable to the fly, and in rather wrinkly flocks, will clear up circumscribed strikes developed since a former treatment, and will do away with the necessity of handling for, conservatively, four weeks, and generally for five weeks. Strike does not occur during the whole of the year. Experiments with which the writer has been concerned, and the experience of numbers of pastoralists, have clearly indicated that a policy of repeated jettings between shearing and crutching and again after crutching (if flies are unusually active, four or rarely five jettings will be needed in the season), offers the outstandingly cheap method



A Jetting-race at Ground Level. In this race, and using the 3-jet nozzle shown, one man treated sheep thoroughly at the rate of more than 200 per hour. They received 2/5 gallon of mixture each. The constant stooping involved is a disadvantage.

of protecting flocks for the greater part of the State and on all except perhaps the smallest holdings where overhead charges for plant become important.* The cost in labour and materials of one crutching and four jettings in the year is less than 4d. per head.

* Pastoralists occasionally report severe strike as early as two weeks after crutching. The writer has had no experience of such incidents, and is of the opinion that they may be explained by the crutching having been applied to flocks already extensively infested, the strike complained of being predominantly re-strike. It is suggested that the crutching of flocks showing many and bad strikes may be avoided by arranging this operation in advance of known fly seasons. For July-shorn sheep on the Central Western or North-Western Plains of New South Wales, this would mean crutching in February rather than in April, and controlling by jetting any unseasonable outbreak of strike that might occur in January or February.

There remain a number of questions concerning the practicability of such an intensive jetting programme, which prevent its unreserved recommendation, and which it is proposed to make the subject of further investigations in the field :

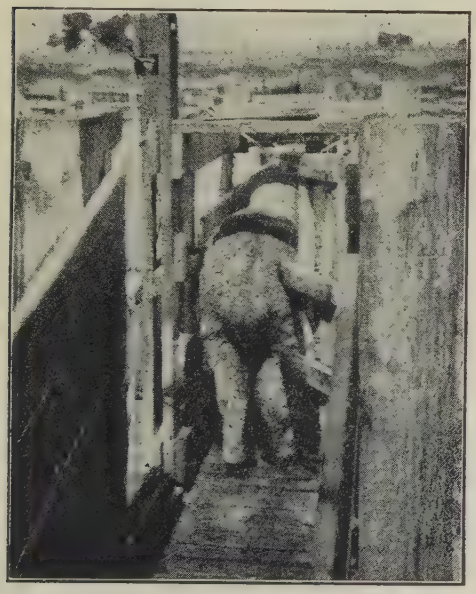
(*a*) *Does a policy of repeated jetting (which in practice requires that a number of sheep shall experience small strikes for part of the time between treatments) result in any loss in wool production?* At Trangie Experiment Farm during several seasons, jetted sheep have seemed as well and to carry as much wool at shearing as unjetted ones. In the 1935–36 season, when the clips were weighed jetted sheep cut considerably more, but they also produced fewer lambs.[14] There were, however, no deaths from fly in the jetted flock, no marks of strikes outside the inner breech area of the fleeces, and fewer " tender " fleeces than

A Raised Race in which the Sheep are Jetted through the Side Fence.

in the untreated sheep. There are graziers who maintain that since they adopted jetting they have reduced losses in sheep and in " tender " and " broken " fleeces, and have increased clips. There are others of the opinion that since jetting does not prevent all strike it is uneconomical. The matter should be investigated thoroughly. The writer's expectation is that any difference recorded in wool return would favour jetting.

(*b*) *Does practical protection by jetting interfere with breeding?* Its employment may make necessary one treatment during lambing. A number of graziers jet during lambing, holding that the one yarding required is much less injurious than the frequent musterings needed for hand dressing. At the Trangie Experiment Farm in the 1935–36 season, jetted ewes returned a

lower percentage of lambs than did the controls[14] ; in 1936–37, when, because of drought, the spring treatments only (i.e. during mating) were applied, the jetted ewes returned a higher percentage.[15] It is most desirable that the question be investigated further, and to distinguish between the influence, if any, of jetting during lambing and of jetting during mating. It is certain that during the autumn of 1936 at Trangie,[14] the jetting of lambing ewes caused no losses among lambs that could be seen by a daily search in a small paddock. Lambings in the district were abnormally low and irregular. No jetted ewes died during the whole autumn period.



A Single-Sheep Raised Pen.
A very efficient jetting device ; for many conditions, the best available.

It is important that the suspicion of interference with mating by jetting should be investigated, since jetting at that period is generally practised and it is quite possible that if mating were disturbed, then a modification of the jetting programme could be devised which would overcome the difficulty.

(*c*) *Can jetting be employed economically against body strike?* This phase is not of prime importance, since serious body strike in the " typical blowfly districts " of N.S.W. is unusual. Experimental jetting against it has been almost impossible to arrange. In each of the past six years, very severe crutch strike has been seen in at least some of the districts where jetting experiments have been in progress. In the autumn periods of 1931 and 1936 in the Central Western Plains area, body strike was seen by the writer on as many as 10 per cent. of some weaners and on a much smaller percentage of older sheep. In other years body strike did not reach $\frac{1}{4}$ per cent. of the flocks concerned in jetting experiments.

It is known[2] [7] that fleece-rot precedes body strike, and it is therefore possible that, warned by continued wet weather, an owner could recognize an epidemic of fleece-rot and jet affected parts to prevent strike. It is almost certain that jetting would be effective if it could be applied at the right time, and fleece-rotted shoulder wool has been jetted with calcium arsenite at half normal strength without showing any further obviously harmful effect to the fleece. Jetting for body strike control should be investigated if the opportunity offers.

(*d*) *Is jetting dangerous to shearers?* The findings of the Queensland Arsenic in Wool Committee[1] showed jetting as extremely unlikely to be dangerous to shearers, yet regulations making illegal the employment of a jetting policy, such as that outlined above, were introduced in that State. Investigations at Trangie Experiment Farm in February, 1937, during the crutching of sheep jetted more frequently and more recently than is normal, indicated that so little arsenic is thrown into the air by the cutters that a shearer would have to work on jetted sheep for six months before inhaling a single medicinal dose of one-twelfth of a grain. It should be considered as certain that no "arsenic hazard" for shearers results from jetting.

The claims made here for jetting are considered to apply to merino flocks in those areas of New South Wales where the blowfly is a pest of real importance; it is realized that in some tableland districts such strike as occurs may most economically be controlled by hand dressing. It is assumed also that almost nine-tenths of blowfly troubles take the form of crutch-strike in ewes. Of other forms, body-strike following fleece-rot (discussed under (*c*)), head-strike in rams, and tail-strike in marked lambs take the predominant part. Much practical experience, but no precise experimental evidence, indicates that jetting is at least as effective for rams' heads as it is for ewes' crutches.

Little or no research has been devoted to the problem of lamb-marking strike, of which the incidence is erratic but at times very important. Claims have been made for good results from jetting on the rail before tailing. They appear optimistic, but should be investigated further.

SUMMARY.

There is at present little promise of finding the "solution of the blowfly problem" by methods aiming at a reduction in the blowfly population.

Of measures which aim at protecting sheep:

Breeding is a long-term matter and the industry needs cheaper protection for existing flocks.

The Mules operation offers a reduction in, but not freedom from, crutch strikes and the necessity for their supervision.

It has not been shown that susceptibility can be reduced by breeding or by surgery to the point where repeated crutching or jetting is unnecessary if constant handling is to be avoided.

Hand dressing cannot be much improved. If the ideal dressing, preventing all restrikes, were discovered, the method would still involve excessive handling of sheep in a fly " wave ". Present dressings give nearly complete freedom from restrike, except in a fly " wave ".

If carcase destruction, trapping, breeding of insusceptible sheep, the Mules operation and improved dressings are all employed to reduce the fly population, or incidence of strike, there will still remain, it seems certain, the economic necessity for some wholesale treatment of flocks.

One crutching in the season is most desirable, but if used to make flocks immune throughout the year, crutching is excessively costly and, in addition, it cannot carry ewes through the lambing period.

Jetting, while slightly less effective than crutching, treatment for treatment, is markedly less costly.

There seem to be excellent reasons for the statement that a combination of crutching and jetting offers not only the cheapest protection against strike, but cheap control of the blowfly pest in the absence of all other methods. But there remain certain questions which prevent the unreserved recommendation of repeated jetting. Experiments at Trangie indicate that some of these possible objections are without foundation. The others, more especially the effect of the treatment on breeding ewes, it is proposed to make the subject of further investigation.

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The Tobacco-Growing Industry in Australia

A REVIEW

By

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Tobacco officers representing the C.S.I.R. and each of the State Departments of Agriculture met in Melbourne on July 13th to 15th last for the third annual conference on research, cultural and extension work. Previous conferences were held at Canberra (*vide* this Journal, Vol. 1, No. 3, pp. 93–95, 1935) and at Brisbane.

As chairman of the conference the opportunity has been presented to maintain contact with the industry and to study its development from a national point of view, so a brief review may be of some interest.

The conference was opened by the Minister in charge of Development and Scientific and Industrial Research (Senator the Hon. A. J. McLachlan) and, in the course of his address, he stressed the value of coordinated effort in the following words: "You gather together each year to represent the far-flung centres of production. In doing this you secure coordination of effort on a nation-wide basis. You are able freely to exchange information concerning cultural and scientific practices and results. The end effect of this is that overlapping and duplication are obviated and scientific research and investigation can be proceeded with as though we were dealing with a single unit of production instead of with areas which are widely scattered . . . it would be well if such cooperation could find its way into various other avenues of endeavour."

Tobacco producing areas are indeed far-flung. Leaf is grown in quantity as far north as Cairns, Q., as far south as Derwent Valley, Tasmania, and as far west as Manjimup, W.A. In other words, scattered over a long range of coastal hinterland, and particularly of over 2,000 miles from north to south, are to be found the tobacco-growing districts, nearly thirty in number. Their product does not meet a local and immediate demand, as is the case with some primary products. It has to be sold in an Australian market and then processed and manufactured to suit the requirements of smokers throughout the Commonwealth. It is therefore vital that the industry progress on a national basis, that the characteristics of leaf be determined by districts and production regulated to conform to the demands of the consumers, and consequently the requirements of the manufacturers.

Fashion and taste in the use of tobacco change in course of time. When first introduced, tobacco was smoked (drunk) in a pipe, but towards the close of the 17th century snuff-taking became fashionable and displaced pipe-smoking to a marked extent. By the end of the 18th century the cigar came into prominence, the spread in its use being due especially to the Napoleonic Wars. The Crimean War saw the establishment of the cigarette as a convenient smoke, but during peace it was generally regarded as effeminate to smoke cigarettes. Gradually, however, their popularity increased, and the Great War settled the matter, while the tremendous increase in the number of women smokers has given an unspoken but unmistakable direction as to the quality of tobacco used. Thus some years ago there was a considerable demand for quite strong tobacco, but now in Australia, as elsewhere, mild-smoking, light-coloured tobaccos constitute by far the major requirement.

This change in consumer requirement has necessitated a re-orientation of outlook, particularly during the last twenty years, on the part of those engaged in fostering the industry. Formerly leaf was chiefly produced on river-flat soils ; leaf which was long and wide, full of " body ", curable by the long processes of sun, air, or fire curing, and eminently suitable for pipe tobacco. Experience has clearly shown that to grow leaf which will be light-coloured and bright, of mild and pleasant smoking quality and so suitable for cigarette tobaccos, the soil chosen must be light and sandy and the climate warm, fairly moist, and equable. Having a suitable climate, the proportion of suitable soil within a given district will, in a large measure, determine the type of tobacco to be grown.

THE POSITION IN 1935–36.

The conference had before it a rough analysis of the position in 1935–36, and this showed that cigarettes comprised approximately 23 per cent., fine cut tobaccos about 57½ per cent., and pipe tobaccos some 17½ per cent. of a total consumption of 23 million pounds. It was recognized that on such a basis there was greatest room for expansion in Queensland and, to a lesser extent, in Western Australia, while the desirable level of production in other States would approximate four million pounds in Victoria, up to one million in New South Wales, and about 500,000 pounds in South Australia and Tasmania. If Australia is eventually to produce at least 75 per cent. of her requirements, then the combined yield of Queensland and Western Australia could be expanded to about ten million pounds, with a preponderance of production in the former.

Until about ten years ago the annual production in Australia was in the vicinity of two million pounds. The British Australasian Tobacco Company and the Commonwealth and State Governments have, since then, provided large sums of money to enable the development of a national, concerted effort

to increase production and to improve quality. Gradually, both these objects are being attained, and at present a yield of about five to six million pounds is looked for each year.

During the past ten years North Queensland and Western Australia have become important producing centres ; Tasmania has entered the picture as a new producing State ; methods of control have been devised for downy mildew in seed beds and for Cercospora leaf-spot ; there has been a definite increase in the production of better quality leaf, largely due to the efforts of State tobacco officers ; and the total yield has been more than doubled. There have been, however, undesirable fluctuations in yield, and the yield per acre has dropped from 737 pounds for the ten-year period prior to 1932 to approximately 500 pounds.

The yield, expressed as a percentage of the total yield, in the various States is approximately as follows : Victoria and Queensland 36 per cent. each, New South Wales and Western Australia 12 per cent. each, South Australia and Tasmania 1½ per cent. each. During the last three years there has not been much variation in the yields in New South Wales and Queensland. In Victoria there have been notable fluctuations, while Western Australia shows a steady and significant increase. Although production is increasing in South Australia and Tasmania, these States, as yet, have little influence on the total yield.

The main producing areas are North Queensland, Texas-Ashford, Tamworth, North-East Victoria and Manjimup, and apparently the climatic conditions and some of the soils in each of these districts are suitable for tobacco, but there are, of course, many other areas where good tobacco is produced in favourable seasons. If we accept these areas as likely to be the main producing centres because some suitable soil types occur in each, then it behoves us to concentrate efforts on them, at least for some time to come.

Prior to 1930, approximately 6 per cent. of the tobacco manufactured in Australia was of Australian origin. This percentage has risen steadily until it is now about 25. To maintain this position a crop of at least 5½ million pounds of usable leaf must be grown each year. For the present it would be better to produce more per acre rather than to increase the acreage, although acreage enlargement will ultimately occur if we are to produce crops of 15,000,000 pounds of usable leaf. Whatever happens it must be recalled that with the present standard of smoking quality the requirement is for light-coloured, bright leaf, and to produce more than the requisite supply of pipe type is deliberately to run counter to consumer demand.

FURTHER INVESTIGATION NEEDED.

Possibly the most outstanding need is a soil survey, or else restriction, as far as is possible, to the use of a few soil types known generally to be

satisfactory for producing good quality leaf. The varieties and fertilizers best suited to those soils could then be determined, and in this connection it is interesting to note that in recent years a feature of tobacco culture in other countries has been the attention paid to varieties. Diseases, particularly downy mildew, tend in some areas to restrict the use of varieties that are probably better than those at present grown, so that particular attention will have to be given to diseases in the field.

If conditions are suitable for the production of flue-cured tobacco, there is seldom any serious difficulty with curing, although of course some growers obtain better results than others. On the other hand, if in any district it is usually difficult to obtain a satisfactory flue-cured product, it may be desirable to modify the method of flue-curing, and possibly air-cured leaf would give better smoking tobacco. For this, however, there is at present no great demand, nor is there likely to be unless the American type of cigarette becomes popular, in which event Burley tobacco would be required.

It appears then that under present conditions it would be advisable to endeavour to increase production as far as is possible on the best soil types in the established producing districts, to concentrate on methods of increasing yield per acre and to develop and maintain varieties suitable for each area. In implementing this programme it is necessary to bear in mind that we require more tobaccos suitable for use in cigarettes or fine cut.

As far as marketing is concerned, the most outstanding requirement seems to be a clearer statement of grades, particularly of the bright tobaccos, and the establishment of standard grades for reference purposes. Later it is possible that some form of cooperative marketing may be found necessary.

The various grants have enabled State tobacco officers to carry out extensive field experiments leading to improved yield and quality. These experiments are concerned with varieties, fertilizers, cultural and curing practices, grading, etc. The delegates to the conference reported that the dissemination amongst growers of the results of these investigations has led to a steady improvement in quality. More attention is being given to the utilization of suitable soils and to practices designed to increase the yield per acre.

It is apparent from this brief review that really satisfactory progress has been made and that the industry is being developed steadily for the mutual benefit of producers and consumers.

In this development, the Australian-wide outlook of all engaged in fostering the growth of the industry is of profound importance.

The Geological Background of Soil Erosion*

By

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Many people in Australia seem to look on soil erosion as a new thing—something that has appeared since the advent of the white man. Others would go a bit further back and blame the aborigines for starting it. As a matter of fact, it has been going on ever since the earth became a solid, since rains began to fall and winds to blow. With literal truth it may be said to be "as old as the hills".

Soil erosion is an essential geological process; without it there would be no geological record, for there would be no sedimentary rocks. The shales and mudstones, the sandstones and grits are composed mainly of tiny mineral particles and rock fragments—soil materials, in fact—that have been swept off the land surface into rivers, and thence into lakes or into the sea. Man has not yet celebrated the one-millionth anniversary of his appearance on the earth, but the agents of erosion and deposition have been at work for a matter of 1,500 million years and more.

It should be noted that if there was no soil erosion there could be no soil deposition. Normally, much of the silt brought down by the turbid waters of a flooded stream is dumped at its mouth to form a delta, or spread out layer upon layer in the lower reaches of the river valley to form alluvial flood plains, and both delta and flood plain give us the deepest and richest agricultural land we possess. To soil erosion that started æons before man was thought of we owe the vast plains of the Hwang Ho, the Mississippi, the Po and a thousand other rivers, as well as the great deltas, such as those of the Ganges, Nile and many others which carry the bulk of the world's population. When we read that the destructive Mississippi floods are caused by reckless misuse of the land in the higher parts of its basin, it is well to remember that similar floods have been taking place in that same river for very many thousands of years, and that the fertile bottoms could not have been formed without them.

Man, then, did not start soil erosion, and it is equally true that he cannot stop it. In this, however, as in many other things, he has hastened the operation of natural forces, and in his civilized state he does increase the rate of erosion very materially. When we talk of the menace of present day soil erosion, we are really referring to *accelerated* erosion brought about not merely by man's misuse of the soil, but by his legitimate use of it as well.

* Summary of address to the Royal Society of New South Wales on 2nd June, 1937.

IN THE BEGINNING.

Now let us go a long way back in the earth's history. During about three-quarters of its existence to the present time, so far as we can learn, there was no organic life of any kind on the land. All living things were in the sea, and the marine animals lived on the marine plants or on each other. The inorganic forces of erosion were at work on the land surface, and the rocks were broken down and broken up to form soil material, just as happens nowadays under the influence of the atmosphere. This material must have been removed almost as fast as it was formed : it was either swept away by the wind or borne down hill by water, and the only places in which it could possibly accumulate were in lakes and other hollows, and perhaps in some of the river valleys. Eventually most of it was swept into the sea.

About 350 million years ago, during what is known as the Silurian Period, a very wonderful and momentous change occurred. For then, according to the geological record, plants first appeared on the land. It is of some interest to us that the earliest vascular land plants of which we have any knowledge made their appearance in south-eastern Australia and Tasmania, so that our continent seems to have been the first part of the world to clothe its primal nakedness with a living garment of green. From lowly beginnings the land plants progressed and developed, so that in the time of our Permian coal measures there were in existence stately forests of lofty trees, besides a wealth of shrubs and ferns and other lowly plants. Then, lastly, perhaps not more than 60 million years ago, the grasses made their appearance.

The importance of the advent of land plants from our present point of view is that it introduced a new and very potent modifying factor into the processes of soil formation and soil erosion. The roots helped to bind the soil particles together, so that a mantle of soil could form even on slopes in spite of gravity and wind and rain. Furthermore, the organic element was introduced into weathering and soil making, and humus was able to form, so that the soil as we know it now came into being. It may be said with truth that while there could be no soil at all without the rocks, there could be no universal soil cover without the land plants. They did not actually stop erosion by their coming, but they modified its incidence very considerably.

The gradual covering of the lands with a mantle of vegetation eventually induced some of the animals also to leave the water, and so we find first the amphibians leading a " double life ", and then the reptiles such as the great herbivorous and carnivorous dinosaurs living wholly on land, followed, in the course of evolution, by the mammals, and lastly by man. Now once the animals set foot upon the land they started to undo in part the constructive work of the plants, for it is virtually impossible for any animal to live upon the earth without promoting soil erosion to a greater or less extent. Some

are more active geological agents than others ; civilized man is the most active of them all, for he clears forests, loosens the ground by tillage, digs out mines and quarries, makes roads with gutters to concentrate the water, and in a hundred ways facilitates and hastens the removal of the soil cover.

There was one event which happened to eastern Australia in the remote past, the effects of which are still operating at the present day to the detriment of agriculture. It is almost axiomatic that the steeper the slope, the greater will be the rate of erosion, and conversely the gentler the slope and the flatter the surface, the more stable is the soil cover likely to be in a region of moderate rainfall where wind erosion is at a minimum. Long ago, perhaps a few million years back, much of what we call the Eastern Highlands of N.S.W. was gently undulating country, not very high above sea-level, with deep soils overlying rocks of many different kinds, and with old rivers meandering through flood plains of their own alluvium.

A series of slow uplifts raised the surface to varying heights above sea-level, forming a plateau. As a consequence, both the east-flowing and the west-flowing rivers were rejuvenated, and started to cut back gorges into the plateau, a work on which they are still vigorously engaged. On the parts of the highlands where the rivers are as yet untouched by rejuvenation, we find the old topography and deep soils, both sedentary and alluvial, of very considerable antiquity, which date back to the time before the plateau was uplifted. In the rejuvenated areas, where slopes are steep and dissection is active, the alluvial soils have disappeared and much of the sedentary soil is sadly truncated. Since the rejuvenated rivers are still eroding headwards into the plateau, the process of soil removal is bound to continue—though of course very, very slowly. In all too many instances, however, it has been accelerated through human agency.

FACTORS AFFECTING RATE OF EROSION.

The rate of soil erosion is affected by a number of factors besides steepness of slope. For example, the nature of the rocks giving rise to the soil, and the rock structures are both important. One type of rock will give rise to a clayey soil whose very fine particles are easily borne off by wind or by surface water ; another produces a porous, sandy soil through which water sinks without much tendency to flow over the surface. Again, it often happens that a series of sedimentary rocks, soft and hard alternately, are dipping in such a way as to form a ridge with a dip-slope on one side and a dip-scarp on the other. If, as one might expect, the surface rock of the dip-slope is hard and resistant to weathering, soil normally forms on it with difficulty and is easily eroded if the vegetational cover is removed ; on the other hand, on the rough, uneven dip-scarp the soil will be deeper and more easily held.

Other factors influencing the tendency to soil erosion are meteorological. In some parts of the world, much of the rain comes down gently and is well spread out through the year. In other places it comes down chiefly in torrents. Where, as in N.S.W. and other parts of Australia, this is the case, rapid erosion is favoured, since the proportion of run-off is unduly great. Again, wind erosion is naturally most potent where the rainfall is low, the vegetative cover poor, and the soil particles dry and easily moved, whereas in areas of moderate to heavy rainfall water is the chief agent of erosion.

Pluvial is more dangerous than æolian erosion for two principal reasons :

(1) It is not so spectacular, and its effects are not so readily observed.

(2) It attacks land which, being in the region of satisfactory rainfall, is likely to be much more valuable than that in the drier areas.

On the other hand, pluvial erosion is active only on slopes, whereas wind action is entirely independent of surface relief.

The more obvious type of pluvial erosion is that which produces gullying ; the more insidious is sheet-wash erosion, by which the finer particles of the soil are gradually moved downhill by sheet-flow of water, i.e. without the formation of definite channels. But the two types often go hand in hand. Gullying is the more immediately destructive, and it may be started in a great many different ways, e.g. by cattle tracks, sheep tracks, cart ruts, plough furrows or rabbit burrows.

LONG-DISTANCE EFFECTS OF EROSION.

As pointed out above, erosion in one place implies deposition somewhere else, and much good land has been utterly spoilt by being covered with drifting sand or with sand and gravel and immature soil material brought down by water from higher levels. In other words, the evil effects of soil erosion are not confined to the immediate area attacked ; there are long-distance effects as well, which may be out of all proportion to the original cause.

Our large rivers are to a great extent supplied from the forests or swampy uplands where they rise. Here the rainfall is held as in a great underground reservoir or in a giant sponge, and makes its way out in the form of springs to feed the streams and give them constant flow. Any action which tends to upset this arrangement is almost certain to have disastrous consequences. The increase in the run-off resulting from deforestation, for instance, or the concentration of water into channels incidental to roadmaking, will cause loss of soil, gullying and destruction of the swamps. Hence in time of heavy rain there will be sudden and increased floodings in the rivers, and thereafter little or no water in them. Other results will be the cutting up of alluvial flats, or their burial beneath sand and gravel, and the silting of reservoirs.

Very wisely, the responsible authorities have allowed no human settlement on the catchment area of Sydney's water supply. But what of the Kosciusko

plateau—the source of important streams like the Murray and the Snowy ? Already in 30 years the throwing of this important area open for tourist purposes has wrought sad havoc, mainly through the killing of trees on steep slopes, and it is a question whether it would not be in the best interests of the State to close the area to all settlement and try to repair the damage by reafforestation.

In the Barrington Tops area we have a plateau which is a portion of the uplifted Eastern Highlands, rising to upwards of 5,000 feet above sea-level, and besieged on all sides by the headwater tributaries of the Hunter, Williams and Manning River systems which take their rise in its upland swamps. Hitherto it has been left almost untouched, but of late we have read that a tourist road has been surveyed across it. That road, if made, will inevitably and unquestionably lead to accelerated soil erosion—especially if there is any alienation of the land in its vicinity—and the results must be disastrous in many ways to the country at the lower levels.

In what has gone before, an attempt has been made to show that soil erosion is governed by well-recognized geological principles, that it is to some extent inevitable in a civilized country, and that reckless or thoughtless action may aggravate it so that it becomes a serious danger. Fortunately, by preventive and remedial measures it is possible to minimise its incidence, but it is a menace with which we can by no means afford to trifle ; it is a problem on which must be brought to bear the very best of our scientific knowledge and skill—geological, botanical and pedological. To all of us it is vital that the soil be conserved ; its destruction strikes at the very root of our national existence. In the words of Shylock :

" You take my life
If you do take the means whereby I live."

Cotton Growing in Queensland

By

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Cotton was first grown on a commercial scale in Queensland in 1852, when 70 bales of lint, the fibrous product obtained from the seed, were shipped to England from the district around Brisbane. The quality of the fibre and the high prices realized aroused so much interest in England that a stream of immigrants started to the colony to grow cotton. Although handicapped by inadequate transport facilities, the new settlers travelled in all directions from Brisbane, and cotton growing on an extensive basis soon could be seen along most of the rivers of south-east Queensland and in much of the district lying between Brisbane and Toowoomba.

The American Civil War interrupted the growing of cotton in the United States, and further stimulated interest in the crop in Queensland, and by 1871 the annual production had risen to $2\frac{1}{2}$ million lb. of lint. For the period 1868 to 1873, a total of 20,044 bales of lint of 500 lb. each was exported to England. Cotton growing appeared to be well established in the colony, but the resumption of cotton growing in the United States following the cessation of the war soon caused prices to fall to unprofitable levels for the Queensland growers, with their high costs of transportation from the farm to England. By 1887 the industry had practically died out in this country, but as Boyd* has pointed out, cotton was undoubtedly the means of settling much of the south-eastern part of the colony, and the returns realized from this crop placed the settlers in a position to engage in other agricultural industries after cotton growing became unremunerative.

FIRST PHASE OF THE PRESENT PERIOD OF COTTON GROWING.

No serious attempts were made to revive the cotton growing industry in Queensland until 1919, when following on the cessation of the World War, prices again rose to such attractive levels that the Queensland Government decided to endeavour again to develop the industry. The earlier period had definitely shown that cotton of good quality could be grown in much of the south-eastern part of the State, and with the reduced production of cotton in the United States, caused largely by the inroads of the boll weevil, it appeared a very opportune time to revive the industry. Accordingly, a guaranteed

* *Vide* The Queensland Agricultural Journal, Jan., Feb., 1914.

price commensurate with that ruling at the time was offered in 1919, when 37,238 lb. of cotton was grown. The interest aroused by the returns brought about a quick expansion in cotton growing, the area under crop in the 1921–22 season being 7,000 acres, which yielded 3,876,677 lb. of seed cotton, the product harvested from the plant.

The rapid increase of acreage indicated that the farmers appreciated the value of a "cash crop" like cotton, and encouraged the Queensland Government to continue the development of the industry under a scheme whereby attractive prices were guaranteed the growers. In addition, the Government acquired the crop, and after paying all handling, ginning and marketing charges, any surpluses were distributed *pro rata* to the suppliers.

An agreement was effected with the Australian Cotton Growing Association to establish ginneries and an oil mill for ginning the cotton and treating the resultant seed. Steps were also taken to develop an organization in the Department of Agriculture to ascertain the best methods of growing cotton, to evolve satisfactory varieties, to grade and supervise the ginning of the crop, to facilitate profitable marketing, and to advise farmers.

Interest in cotton growing increased astoundingly, and was further stimulated by the Commonwealth Government agreeing to share equally with the State any losses incurred through the guaranteed prices. This applied also to all States, and investigations were carried out in the most likely parts of the other States to ascertain the possibilities of cotton growing. Sufficient seed was distributed in Queensland in the 1922–23 season to plant 50,000 acres, and as was to be expected, cotton growing was tried on all classes of land and by all sorts of people. Cotton growing companies in which people purchased shares at high prices were formed, land values rose to absurd levels in the districts producing the highest yields, and the inevitable "crash" occurred with the first season yielding poor results, which was fortunately in 1922–23. It was clearly indicated that cotton growing required sound agricultural practices, like any other crop. Nearly the same acreage was planted in the following season, however, but with approximately the same average yields, which caused a marked reduction in the area under cotton in 1924–25. About a 50 per cent. increase in yield per acre resulted that season, but as 1925–26 was the last season of guaranteed prices and no definite plan for the further fostering of the industry was formulated, only 25,000 acres were planted that year. At the close of the period of guaranteed prices, it had been demonstrated that cotton could be grown successfully on certain extensive classes of soil in several districts of the State, suitable varieties of cotton had been introduced and partially acclimatized, and an efficient extension and grading service had been developed. No organization existed, however, to control the industry, and the sudden change from profitable, guaranteed prices to the marked uncertainty of returns in the export market made the future of the industry most uncertain.

SECOND PHASE OF THE PRESENT PERIOD OF COTTON GROWING.

It became necessary, therefore, to provide some form of organization for the industry, and legislation was accordingly passed by the Queensland Parliament whereby all seed cotton produced in the State had to be marketed through a compulsory pool controlled by a commodity board composed of farmers' representatives and the Director of Marketing of the State. Representations were made to the Commonwealth Government that bounties be paid to assist the growers in the transitional period from governmental to grower control. The late Hon. H. E. Pratten, Minister for Trade and Customs at the time, realized the necessity of assisting the growers during this critical period, and also appreciated the fact that a substantial cotton growing industry would require an Australian spinning industry to provide a profitable market for most of the produce. Accordingly, in 1926 a bounty system was inaugurated to assist the growing, spinning and knitting industries.

Under such a developmental scheme the acreage under cotton and the number of growers increased slowly but steadily from 20,100 acres and 2,080 growers in 1926–27 until 1932–33, when, following the effects of a severe drought and a marked reduction in world prices for cotton, a stationary period set in wherein around 60,000 acres have been grown annually by varying numbers of farmers ranging from 3,001 in 1932–33 to 3,364 in the past season. The highest total yield obtained was in the 1933–34 crop, when 17,471 bales of lint, averaging 500 lb., were produced, the value of which, along with the by-products, was £481,700.

In 1935 the Tariff Board recommended that a greater home market should be provided for the Australian spinners, and accordingly a protective tariff—estimated to be just sufficient to enable the spinners to operate profitably if on an efficient basis—was granted on yarns for knitted goods, tweeds, gabardines, drills, dungarees, denims, jeans and cordage, as well as condenser yarns for the manufacture of blankets. It was also stipulated that the values of Australian cotton should be the gross cost of imported cotton of similar grade and fibre length in order that the spinners should have every opportunity to produce economically. It was realized that a considerable proportion of these classes of goods would be manufactured from types of cotton of lesser value than those which had been more extensively produced in Queensland in the past, as owing to the necessity of exporting some of the crop, mostly cotton of medium to semi-long staple type commanding good premiums had been grown. A scheme of compensating bounties on lint cotton was therefore inaugurated, whereby for every 100th of a penny rise above the spot price of sixpence a pound for middling grade lint on the Liverpool market, the bounty would drop proportionately until eventually no bounty would be paid when prices rose above eleven pence. This limit was reduced 0·5 pence per pound of lint for the 1935–36 season, with a further similar reduction in 1936–37, the latter level to operate for the next two seasons.

Under this scheme there has been a most pronounced increase in cotton spinning and weaving, and around 23,000 bales of lint cotton have been consumed during the last twelve months. Unfortunately, most exceptionally adverse climatic conditions during the last two seasons in most of the cotton growing districts of the State have reduced crop yields to such an extent that the home requirements have not been provided. This quantity of cotton can be produced with little difficulty under more normal conditions, and it is anticipated that even with the lesser values that will be obtained from the reduced bounties a considerable expansion of acreage under cotton will occur in the immediate future. Cotton, being a markedly drought-resistant plant, has withstood severe adverse conditions in a manner far superior to other crops, and the farmers are thoroughly impressed with the value of cotton growing in their cropping operations.

ORGANIZATION OF THE COTTON GROWING INDUSTRY.

The development of the cotton growing industry under a compulsory pool has permitted the organization of the industry on a very efficient basis. All expenses are paid by the pool after the grower places his produce on rail at his nearest station, and approximately 80 per cent. of the estimated value of the cotton in each container is paid to the grower within a few days after its arrival at the ginnery.

The cotton is graded by Queensland Government graders shortly after receival at the ginnery, not only to estimate its value, but to ensure the accurate segregation of the different qualities in order that a uniform content in each bale of the ginned product may be obtained. As the cotton is graded according to the World's Universal Standards for American Upland cotton, which is the type of cotton grown here, Queensland cotton can be sold to the best advantage on any cotton market. Having the marketing of the crop under one central control also allows of its being sold direct to the spinners in Australia without incurring brokerage charges.

In 1930 the ginneries and oil mill were purchased by the growers' organization, and since then a marked reduction in operating charges has been effected, as well as increased efficiency of operation obtained through the modernization of the equipment. The standard of work performed and the costs of operation now compare very favourably with those of similar organizations in other countries.

VALUE OF THE COTTON GROWING INDUSTRY TO QUEENSLAND.

The establishment of the cotton growing industry in Queensland has been very valuable in developing large areas of this State. Much of the cotton is grown in districts with a mean annual rainfall varying from 25 to 35 inches, which is characterized by very irregular distribution and intensity of occurrence.

In many of these districts the yearly evaporation is approximately 60 to 70 inches, and crops with marked drought-resistant properties are required. Long haulages to any substantial market also limit the choice of suitable crops. As a result, dairying is the major industry of most of these districts. Cotton has been proved to be eminently suitable for such conditions, however, on account of both its drought-resistant properties and its relatively high value per unit weight as compared with any other crops that can be grown. Also cotton is undoubtedly the most suitable crop for planting in the residual ash after newly fallen scrub is burnt. There are large areas of dense scrub in most of these inland districts, and thousands of acres have already been brought into production through planting cotton in the ash amongst the stumps, and sowing Rhodes grass at the end of the season for dairying purposes. Within three years of falling the scrub the tree stumps can be cleared from the land economically, and much of it is then brought under the plough for the cultivation of cotton and fodder crops. Cotton growing helped to develop the early settlement of south-east Queensland, and undoubtedly has and will continue to play an important part in the present phase of agricultural development in the area lying between Rockhampton and the southern border, and the coast to as far west as Roma, a province roughly 60,000 square miles in area.

PROBLEMS ENCOUNTERED IN GROWING COTTON.

During the first few seasons of the present period of cotton growing, the climatic conditions were fairly suitable for producing good yields of cotton on nearly every kind of agricultural soil of reasonable fertility. With successive cropping to cotton, however, very poor results were frequently obtained on areas that had produced excellent returns in the previous crops. Varietal tests and various cultural methods all failed to remedy the difficulty and ensure profitable yields on land which had been cropped for some years. The problem was particularly acute in the older settled districts at first, but later also occurred to a large extent in the districts thrown open for agricultural settlement in 1924. Soils brought under cultivation for the first time and planted to cotton frequently produced yields of as much as 2,000 to 2,400 lb. of seed cotton per acre for the first three seasons. From then on they often failed to yield 300 lb. per acre in seasons of heavy, mid-seasonal rainfall, or when severe attacks of corn ear worm (*Heliothis obsoleta*) were experienced, even where the same variety was grown under similar methods of cultivation. It became obvious, therefore, that some important fundamental principle was involved.

Soil studies were instituted in the Callide Valley at the Cotton Research Station, which was established in 1924 with the help of substantial contributions by the Empire Cotton Growing Corporation. These indicated that during the mid-seasonal growth period the nitrate content of the older cultivations of the fertile alluvial clay loams, on which most of the cotton was grown, rose

to very high levels as compared with adjacent cultivations in the first three seasons following the clearing of the native vegetation. Old cultivations, with a nitrate content of 4 to 6 p.p.m. in the upper six inches of soil when planted in October, contained up to a mean of 45 p.p.m. at mid-season, with occasional samples having readings as high as 90 p.p.m., whereas the newer cultivations seldom rose above 15 p.p.m. and only occasionally contained 45 p.p.m. when incubated for six weeks. During these periods of high nitrate production the cotton plants made excessively rank growth on the older cultivations unless favourable weather conditions had permitted planting early in the spring, when the nitrate content of the soils and the temperatures were so low as to cause only slow development of a stocky type of plant. Such growth favours early setting of the flower buds and bolls, thereby providing for a steady utilization of the nitrogen intake, and thus preventing the storage of excessive amounts of it during the vegetative stage of plant growth.* It was also ascertained that as a result of the decomposition of the organic matter accompanying rapid nitrate production, the physical condition of the clay and clay loam soils became seriously impaired and the efficiency of the rainfall was markedly reduced. In some experiments, after even steady soaking rains, the old cultivations trapped less than half the amount of moisture absorbed by cultivations in the first season out of grassland.

The problem was thus narrowed down to finding a suitable rotation which would keep the nitrate production at a sufficiently low level to prevent rank growth of the cotton plant, and to maintain the soil in a sufficiently permeable condition to trap ample supplies of moisture. The results obtained at the Research Station in the rotation studies indicated that little assistance could be expected from the ordinary grain and fodder crops suitable for the district, so Rhodes grass (*Chloris gayana*) was tried, and even after only two years of growth appreciable gains were obtained in the two subsequent crops of cotton. Farmers in the district have also obtained pronounced gains from large scale demonstrations of the value of rotating cotton with Rhodes grass, and the research and extension activities are now mostly centred on this rotation.

Studies have also been made as to the merits of this rotation from the point of view of the dairyman, as most cotton growers also engage in dairying. It has been demonstrated that not only does rotating the Rhodes grass with cotton (such as, say, three years of cotton, then three years of grass) increase the annual yield of grass from two to fourfold as compared with old Rhodes grass pastures, but the feeding value is greatly improved both as to nutrient content and attractiveness. The rotation is thus highly beneficial to dairymen in the drier districts, and will enable the carrying capacity of a large area of country to be appreciably increased. As the cotton plant will function to much better advantage under conditions of low rate of nitrate production

* *Vide* The Empire Cotton Growing Review, April, 1934.

following the breaking up of the grass than will the other crops suitable for the district, it becomes all the more imperative for the farmers of these areas to include cotton growing on a substantial scale in their cropping system.

VALUE OF THE COTTON GROWING AND SPINNING INDUSTRIES TO AUSTRALIA.

The cotton growing and spinning industries employ labour extensively. In the season of highest production, 17,471 bales, cotton growing contributed largely to the incomes of some 3,764 growers. Also, about 4,000 pickers were engaged for a considerable period in harvesting the crops. As some 150,000 bales of lint would have to be produced in Australia to enable this country to supply its requirements of goods manufactured from the types of cotton grown here, it will be realized how much employment cotton growing and spinning could provide. The cotton growing industry is also of value to the Commonwealth from the point of view of national defence in all its ramifications. The by-products obtained from the cotton seed contribute materially to the welfare and economics of the country. The linters or short fuzz remaining on the seed after the commercial fibres are removed in the ginning operations, are cut off prior to the seed being crushed, and are used in Australia for the manufacture of medicated lint, feltings and motor car upholstery, and can also be used in the manufacture of ammunitions. The hulls removed from the seed after the latter are crushed provide valuable roughage for fresh milk suppliers in the districts adjacent to the oil mill at Brisbane ; the oil extracted from the kernel of the seed is used in the manufacture of cooking margarine by bakers, and also in cooking fish in restaurants, while the meal made from the kernels after the oil is extracted is one of the best concentrates for feeding dairy cows. In times of drought, it is also most valuable in the form of small pressed cubes or " nuts " for feeding stud flocks of sheep, a quarter of a pound of nuts a day along with some roughage being sufficient to keep a sheep in a fairly satisfactory condition. Several thousand tons have been used for this purpose since cotton growing has been established in Queensland.

CONCLUSION.

It can be appreciated from the above account that the cotton growing industry has played an important part in the development of a considerable portion of the south-eastern section of Queensland. When grown in a proper rotation cotton is undoubtedly well suited to much of the inland portions of this section of the State, and is required by many farmers. As the industry is an extensive employer of labour in both the growing and manufacturing phases, its expansion is of the utmost importance to the Commonwealth as a whole, particularly as its fullest development would eliminate the necessity of drawing on the funds obtained from exports, to the extent of several million pounds a year.

Recent Advances in the Study of Plant Nutrition*

THE PHYSIOLOGY OF PLANT NUTRITION.

Advances in our knowledge of the physiology of plant nutrition are slow, mainly because of the great complexity of the subject. Some new conceptions are, however, emerging, and some of these may be selected for discussion. One is that the effect of a nutrient on the plant cannot be considered apart from the growth stage of the plants we are studying. Thus increased phosphorus supply increases the nitrogen content in a young plant because it increases the rate of protein synthesis; later, however, on account of the increased size of the plant, the nitrogen supply becomes more rapidly exhausted, and the nitrogen content is decreased.

New knowledge is also being obtained concerning the interaction between nutrient elements. On account of the importance of proteins as the chief constituents of protoplasm, in metabolism and growth, any factors are important that increase the ratio of protein to non-protein nitrogen. Water supply is one such factor; decreasing water content causes protein hydrolysis, a fact which is probably of considerable significance in the effect of drought on plants. When phosphorus supply is low, protein synthesis is greatly decreased in rate, and there is a large accumulation of nitrogen as amides. Potassium deficiency also decreases the rate of protein synthesis, nitrogen accumulating both as amides and amino-acids.

A new conception, which is really an attempt to express the efficiency of the protoplasm, is based upon measurement of the rate of growth of the plant per unit of protein in the leaves. Here protein is taken as a measure of the amount of active protoplasm in the leaves. The rate is increased by increase in phosphorus supply, but with increasing nitrogen supply it falls, although the actual amount of protein is increased; this may be because in the larger plant produced there is a shortage of some other nutrients.

The living state, with its associated properties of synthesis and growth, is a result of the colloidal state of the protoplasm, which is highly sensitive to changes in the intracellular environment. Various nutrient elements may influence metabolism by virtue of their effect on this environment.

These and other conceptions are of great importance in the study of the relation of nutrition to the progressive physiological changes through which the growing plant proceeds, and in the study of the interrelations among these changes. These studies lead to the realization that the composition of the plant within certain limits is capable of control. This can be achieved by

* Outline of contributions to a general meeting of the South Australian Branch of the Institute, held at Adelaide on 25th June, 1937.

varying the nutrient supply. It can also be achieved by altering the interrelations among the growth processes and so altering the nature of the changes through which the plant passes with time; vernalization and change in the length of the period of daily illumination will produce such alteration. A third method of achievement is by making use of the phenomenon of varietal difference in the composition of the plant. This opens up a great field of prospective work in the comparative biochemistry of groups, species and varieties of plants.

These questions of composition are of considerable significance in plants where quality is important, e.g. tobacco, cereals, etc. Possibly it may be found that such questions are important in pasture plants too; thus the proportions of different amino-acids in grasses may be found to be of importance in animal nutrition. It is therefore clear that advances in knowledge of these aspects of plant nutrition may be of great value in agriculture.—*A. H. K. Petrie.*

THE NUTRITION OF HORTICULTURAL CROPS.

The last decade has been marked by revolutionary changes, not only in the methods of investigating the nutrition of fruit trees, but also in the general outlook of horticultural workers in this subject; and there has developed a better realization of the intimate relation between fruit tree growth and fruit production. The fact that treatment affecting the vegetative condition must ultimately affect fruiting has only become appreciated in the last ten or twenty years.

Until comparatively recently, investigational work on the mineral requirements of fruit trees was virtually restricted to the conduct of non-replicated field experiments—trials which, for reasons now obvious, yielded very sparse information.

The horticultural field experiment has, in the last few years, however, become more valuable owing to the application of sound plot technique; the order of variability of fruit production has been investigated, root stocks standardized with the object of reducing inherent variation, while replication and randomization have become more general.

Synchronously with improvement in field experimental technique, various new lines of approach have been evolved and are useful adjuncts to field trials.

Most productive of these has been the use of pot cultures to establish mineral deficiency symptoms. The symptoms arising in apple trees and other fruiting plants from a deficiency of such minerals as potash, nitrogen, calcium and so on, have been established, and this information has proved of considerable diagnostic value in the field.

A further development has been the device of direct introduction of minerals by means of injection, in solution or in solid form, or by leaf absorption from sprayed solutions. These methods of direct entry to the top portion of the tree are of value in studying the reaction of trees to the major nutrients,

and perhaps more particularly to the so-called minor elements, zinc, boron, manganese, etc. Direct introduction in this way has been of practical value in the correction of "internal cork" of apples by the injection of boron, of apple "leaf scorch" by the injection of potash, and of "mottle leaf" in citrus by spraying or injection with zinc.

The horticultural worker has difficult material to study; fruit trees are long-lived and semi-permanent in nature, always comprising a relatively small number of individuals per unit area of land. However, the advances that have been made in the investigation of nutritional problems of fruit trees have helped to compensate for their biological deficiencies as experimental material.—*A. G. Strickland.*

THE NUTRITION OF HERBAGE PLANTS.

A considerable amount of grassland investigation has been carried out in recent years, but a good deal of this appears empirical when viewed from the standpoint of nutrition. Work of a physiological nature seems to be of greatest significance in providing better interpretations of the nutrition of herbage plants.

Certain difficulties are inherent in all pasture experiments. The pasture firstly is an association of widely differing species, characterized by differential growth rates and different responses to treatment; inter-specific and inter-varietal competition are features. The simplest expression of this association is the combination of single grass with single legume; the fundamental nutritional problem is that relating to phosphorus and nitrogen status, other nutrients tending to be more or less subsidiary. Complex as it is, the nutrition of the pasture association is only part of the whole problem, as the final aim is the nutrition of the animal, which will depend on the type of production in view.

In regard to minor elements, the recent New Zealand work with cobalt is of interest. The application of cobalt chloride greatly increases the cobalt content of cobalt-deficient pasture, without improving growth. Phosphate appears to enhance, and lime to depress, the uptake of cobalt. Cobalt exercises a selective herbicidal effect, as in the case of copper and iron salts, tending to eliminate clovers and succulent weeds at concentrations which do not affect grasses.

In South Australia, the relation of phosphorus and nitrogen supply, under varying conditions of defoliation, has been investigated in relation tc (*a*) pure grasses, (*b*) pure legumes, (*c*) associations of a single grass with a single legume, grown simultaneously with the pure species. This work has been carried out mainly in pot cultures, with, wherever possible, parallel field experiments. There is much to be said for the controlled sand culture, for the investigation of a principle or principles. Less can be said for the soil culture or the water

culture, although in certain cases these have also proved of value. In field experiments the proper provision of the grazing factor, individual grazing of plots and determination of both grazing yield and hay yield are necessary. In modern pasture experimentation factorial design involving a comprehensive treatment range and low unit replication is practically indispensable.

Investigations of the effect of phosphorus and nitrogen on legumes have shown that the dry matter response of a pure legume tends to follow the typical Mitscherlich relationship, and that rhizobial nitrogen fixation per unit of dry matter is accelerated by increasing phosphate. Soluble phosphate also stimulates the mobility of the flagellated form of Rhizobium in the soil and leads to more rapid infection and an increased number of nodules.

Soluble nitrogen when applied to pure legumes tends to stimulate early development quite markedly, but interferes with the root hair deformation which is a necessary prelude to infection, and invariably leads to a reduced number of nodules and decreased fixation of free nitrogen. Increased uptake of applied nitrogen and decreased fixation tend to exercise compensating effects on yield, so that in the final event there is little or no difference in the yield of pure legumes due to nitrogen application. Legumes are able to tolerate surprisingly high dressings of nitrate or ammonium nitrogen in the absence of competition, provided photosynthesis is active and there are no exosmotic or burning effects. Work at Wisconsin has shown that response to nitrogen is greatly dependent on the C : N ratio.

Grass is extraordinarily rapid in nitrogen uptake, and protein synthesis is more rapid from NH_4 absorption than from NO_3. An excess of nitrites in the plant has been correlated with so-called " grass tetany " in England. Certain overseas workers have claimed that nitrogen uptake may occur in grasses as a result of their association with legumes when the latter are in an early vegetative condition. No evidence has been found for this hypothesis in pasture mixtures grown in the winter rainfall season of South Australia, but there is evidence of limited donation in the case of mixtures including perennial legumes, grown in spring and early summer with the aid of artificial watering.

The effect of phosphorus on grass-legume associations is dependent on the nitrogen level. At a low nitrogen status, phosphorus application results in legume dominance ; as the nitrogen level rises an increasing part of the response is appropriated by the grass, until at high phosphorus and nitrogen, complete grass dominance is attained. The effect of nitrogen application is invariably to increase the grass content at the expense of the legume content ; in the case of aggressive associate grasses, little or no increase in yield can be expected, over a period of seasons, as a result of nitrogen application, owing to the compensating effects of grass increase and legume decrease ; and nitrogen recovery is in general depressed. The above principles apply in general to

both " single cut " conditions and conditions of persistent defoliation, except that under defoliation the competitive effects of certain species are reduced and the requirements of non-legumes for nitrogen are greatly increased.—*H. C. Trumble.*

THE NUTRITION OF CEREALS.

Early investigations of the nutrition of cereals, based on water cultures, sand cultures, artificial soils and numerous controlled field experiments, showed that nitrogen, phosphorus, potassium, magnesium, calcium, iron and sulphur were essential for the healthy development of cereals. More recently it has been shown that manganese, boron and zinc are essential for certain plants, whereas sodium, chlorine, aluminium and silica are often present in considerable amounts. Some seventeen other elements have been sporadically detected in crop plants, but so far as is known their presence in the plant is accidental.

The substances of physiological importance may be classified into three groups—water, inorganic salts, and organic compounds.

Water is of significance as the solvent in which nutrients migrate, the medium in which metabolic changes take place, the reacting component in photosynthesis, hydrolysis and other physiological functions, in addition to being an essential constituent of protoplasm.

Under Adelaide conditions, the quantity of water required to produce a ton of wheat grain (37½ bushels) is 1,150 tons. Species, season and soil fertility are all of importance in determining the water cost of dry matter production. Allowing for the loss by soil evaporation during seasonal growth, it is estimated that under Adelaide conditions 17½ inches of seasonal rainfall would be required to produce a 37½-bushel crop of wheat and about 12½ inches of seasonal rain to produce a 45-bushel crop of barley per acre.

Transpiration losses are dependent on two major factors : (1) the area of the green transpiring surface of the plant, (2) the intensity of the environmental factors (i.e. mean air temperature, saturation deficit and wind movements), which varies according to the nature of the seasons.

It has been shown that transpiration is closely correlated with the rate of evaporation from a free water surface during the growing period ; and any conditions leading to a high evaporation rate during the critical period of transpiration will inevitably cause heavy transpirational losses.

On soils lacking soluble phosphate, nitrogen or manganese, the transpiration ratio has been found to be reduced to the extent of 20 to 40 per cent. by the application of the appropriate fertilizer.

The inorganic salts needed for the nutrition of cereal crops are supplied by the soil in the form of solutes which are absorbed by the root system, and conducted upwards and outwards to all parts of the plant by osmosis. Any ion occurring in the soil solution will be absorbed by plants provided the cell

membranes are permeable to that ion. As long as the plant is living, and chemical change goes on in the soil, there can be no equilibrium for any of the essential ions, since continued liberation within the soil and consumption by the plant will maintain diffusion gradients.

Phosphorus is of greatest significance under Australian conditions, and has been found to be of special significance during the early stages of growth. Phosphorus is an essential constituent of nucleo-protein, and is necessary for cell division and the transformation of starch. The application of phosphate leads to greater root development and earlier maturity of the grain ; both of these effects are of decided advantage in dry seasons in Australia. The water requirements of cereals are normally reduced by 15 to 20 per cent. by the application of soluble phosphate, and the phosphate content of the plant is increased. Phosphate is much more effective on fallow than on stubble land ; at the Waite Institute, the increase in the yield of wheat over five seasons, due to the application of 2 cwt. superphosphate per acre, was 22½ bushels per acre on fallow and only 3·2 bushels on wheat stubble.

Applications of potash have so far given negative results with cereals in Australia ; lime has given mean increases of 3·4 bushels of wheat and 7·1 bushels of barley over a period of ten years at the Waite Institute.

The application of manganese sulphate has overcome manganese deficiency in oats on the Mount Gambier volcanic ash soil, the black clay humus soil from Penola, and the light calcareous soil of Yorke Peninsula and Eyre Peninsula in South Australia. The amount of manganese superphosphate supplied by the trade in South Australia in 1936 was 481 tons, sufficient to sow 8,000 to 10,000 acres.

The practice of growing wheat on well cultivated fallow has obscured to some extent the importance of nitrogen in cereal production. In a fallow soil, nitrification is particularly active in early summer and in autumn. The nitrate nitrogen content of a stubble soil, however, rarely contains sufficient nitrogen to meet the requirements of a good cereal crop. Over a period of five years, the application of 1 cwt. of sulphate of ammonia has increased the yield of wheat by 5·8 bushels per acre, and both barley and oats by 16½ bushels per acre, when sown on stubble land at the Waite Institute. The increased yield of wheat and barley was due almost entirely to the increase in the number of ear-bearing tillers ; in oats the increase was due mainly to increased size of the panicles.

The response to nitrogen is likely to be conditioned by the magnitude of the seasonal rainfall, the soil type—red-brown earths and podsols appear to be most responsive—and the previous treatment of the land, including the relative prominence of temporary leguminous plants.—*A. E. V. Richardson.*

TECHNICAL NOTES

THE PREVENTION OF BLUE STAIN IN HOOP PINE LOGS.

Owing to the considerable losses due to degrading of hoop pine logs (*Araucaria cunninghamii*) on account of bluestaining, caused principally by the fungus *Diplodia pinea*, control experiments were carried out under the auspices of the Queensland Sub-department of Forestry, in the Mary Valley.

One hundred and seventy logs were used in a series of experiments which aimed at :

(i) Determining the period required for the development of bluestain under field conditions, and finding the site at which infection usually occurs in the rain forests, at the loading ramps, and on or off the ground on skids.

(ii) Testing various treatments, chemical and physical, which were considered likely to check the development of staining.

The experiments were repeated at fortnightly intervals during a period of eight weeks, commencing in January, in order to ensure that appropriate weather conditions for the development of bluestain were obtained. The bluestaining period normally extends right through the summer months from October to the end of April. Full-length logs were used in the tests, and at the conclusion of each experiment the logs were bisected longitudinally, the cut surfaces being then planed to facilitate the measurement of the penetration of the stain.

DEVELOPMENT OF BLUESTAIN IN THE RAINFOREST.

A number of logs were milled each week to provide information on the development of staining in barked logs (logs are normally barked at felling) held at the stump or at rainforest loading ramps. Lateral penetration of the stain did not reach serious proportions until the fourth week, but end penetration developed more rapidly. The position of the logs, whether on the ground or on skids, apparently made no difference in the amount of degrade.

DEVELOPMENT OF BLUESTAIN OUTSIDE THE RAINFOREST.

Bluestain developed more rapidly in logs held on ramps outside the rainforest than in logs within the timbered area, and was worse on skids than on the ground. This was no doubt due to warmer temperatures and quicker drying. These same factors also probably influence the quicker staining at the ends of the logs which, however, does not involve a great volume of the timber in each log.

ANTI-STAINING TREATMENTS.

The treatments used were :

(*a*) *Bark Off.* (i) Lignasan (ethyl mercury chloride). (ii) Bordeaux mixture. (iii) Creosote soap emulsion. (iv) Quartzite (meta sodium silicate). (v) Controls.

(*b*) *Bark On.* (i) Creosote-vaseline paint on cut ends. (ii) Untreated ends.

The treatments were carried out both at the stump and the scrub ramps, except in the cases of (*b*) (i) and (ii) where the logs were left at the stump because hoop pine, owing to its rough bark, makes " snigging " or ground skidding difficult if unbarked and is consequently always stripped at felling.

The materials in (*a*) (i)-(iv) were sprayed on to the logs with a knapsack spray pump, and the distribution in the rainforest of the logs with the same treatment was varied as much as possible.

Lignasan exerted much better control over staining in barked logs than any of the other fungicidal treatments, either in the rainforest or at the ramps out in the open. Sap-staining fungi did not discolour Lignasan sprayed logs for seven weeks, while bluestain was clearly visible in untreated logs within the fourth week of felling. Bordeaux mixture was next in efficiency, followed by creosote emulsion and quartzite, in that order. Quartzite has little or no effect on bluestain development, treated logs being quite as bad as the controls.

Logs left with the bark intact remained perfectly clean, provided the ends were sealed, but were very difficult to bark after the lapse of a few days ; hence the costs of this treatment are high. However, when logs are held in the rainforest for some time, as in the case of some trees felled for seed collection purposes in an area which cannot be exploited immediately, this method should ensure the preservation of the logs until they can conveniently be removed. Logs with untreated ends always exhibited end penetration of the staining fungus.

POINTS NOTED DURING THE EXPERIMENTS.

Logs placed on skids in the open were more severely stained than those on the ground.

The upper side of logs on the ground was more stained than the lower side.

Bluestaining did not markedly develop in untreated logs held in the scrub until the fourth week.

Some trees appeared to possess an individual resistance to staining.

Further development of staining took place after milling.

Only the sapwood was affected by staining during the experimental period.

Experiments proved that fungicidal sprays, to be effective, must be applied within twenty-four hours of felling and barking.

Lignasan did not check borer damage, and since as much degrade is allowed for this as for staining, treatment for the sole purpose of preventing staining would be of little value in obviating degrading of the logs. It is therefore necessary to remove the logs from the stump to the mill as soon as possible by co-ordinating cutting, hauling and milling as closely as weather conditions will allow.

Logs left with the bark intact and having the ends sealed were free from fungus damage.

Department of Agriculture and Stock, Brisbane, Queensland. H. E. Young.

MOISTURE CONTENT FLUCTUATIONS ON IRRIGATED SOILS IN SOUTH AUSTRALIA.

INTRODUCTION.

During the course of irrigation investigations in South Australia, an account of which has already been published,[1] a study was made of inter-irrigation soil moisture fluctuations on three sites which had been selected for controlled irrigation. The soil types on the three sites have been described and classified by Marshall and Hooper[2] as :

(i) Barmera sandy loam.
(ii) Berri sandy loam.
(iii) Loveday sandy loam.

The three plots had a similar length of irrigation run, the surface gradients were in the main comparable, and as far as practicable, irrigation procedure was standardized.

EXPERIMENTAL.

The moisture contents used throughout were those calculated just prior to watering, as such determinations give the best estimate of soil moisture retention between irrigations. A central vine row was selected on each plot, and samples were taken just prior to the second, third, fourth and fifth irrigations during the season 1934–35. The dates of sampling were October 1st-3rd, December 1st-3rd, January 11th-14th, and March 30th-April 2nd.

The samples consisted of duplicate series, at 6-inch intervals from the surface to a depth of three feet, taken at both the upper or headland end, and the lower or footland end of the row. Thus on each site there were four holes, each yielding six samples, at each irrigation.

Water table observations were taken on all plots, and fluctuations of levels at the various times of sampling were :

(i) Barmera sandy loam : 7 to 8 feet from the surface.

(ii) Berri sandy loam : 5 to 7 feet from the surface.

(iii) Loveday sandy loam : 6 to 11 feet from the surface.

Moisture contents, calculated on an oven-dry (105° C.) basis, are shown in Appendix I. An estimate of texture was obtained by determining the heat of wetting for each soil-type and depth (Table I).

Table I.—*Heat of Wetting in cals./grm.*

Depth. (Inches.)	Barmera Sandy Loam.	Berri Sandy Loam.	Loveday Sandy Loam.
0–6	1·53	2·59	2·41
6–12	1·53	2·40	2·59
12–18	2·44	2·32	2·61
18–24	3·74	1·97	2·62
24–30	3·68	1·89	2·64
30–36	3·22	1·77	2·58

The soil moisture contents are presented as such, and no correction for texture was made. By comparison with wilting points directly determined on soils of similar texture, it was possible to make a reasonably reliable estimate of the wilting coefficient of these soils. This would vary from 3 to 5 per cent. in the top foot, 4 to 6 per cent. from 12 inches to 24 inches, and 6 to 8 per cent. from 24 to 36 inches.

EXAMINATION OF RESULTS.

Fisher's method of analysis was used. The error variance was determined after eliminating the variance due to soil type, date, depth, position (headland or footland) and their various interactions. A comparison of mean moisture contents at each irrigation revealed that the soil became progressively drier, as measured in pre-irrigation samples, as the season advanced (Table II).

Table II.—*Mean Moisture Percentages at each Irrigation.*

Soil Type.	Irrigation.				Significant Difference.
	2	3	4	5	
Barmera sandy loam	13·5	12·8	10·7	8·6	
Berri sandy loam..	13·5	13·7	12·1	11·7	0·5%
Loveday sandy loam	14·7	14·6	12·9	10·0	

With regard to depth, the moisture content was lowest in the top six inches, and increased progressively to a depth of two feet. From two to three feet it appeared to be fairly constant (Table III).

Table III.—*Mean Moisture Percentage at Each Depth.*

Depth. (Inches.) —	0–6	6–12	12–18	18–24	24–30	30–36	Significant Difference.
Moisture —	8·3	10·0	12·9	14·7	14·3	14·2	0·35%

The same general conclusion held good when each irrigation was considered separately (Table IV).

Table IV.—*Moisture Percentages at Various Depths at Each Irrigation.*

Depth. (Inches.)	Irrigation.				Significant Difference.
	2	3	4	5	
0–6	10·4	8·6	7·6	7·0	
6–12	11·7	10·5	9·5	8·1	
12–18	14·9	14·4	12·2	10·0	0·73%
18–24	16·2	17·1	14·0	11·6	
24–30	15·6	15·8	13·9	11·7	
30–36	14·6	15·6	14·1	12·5	

Barnard[3] has shown that the root system of the vine under irrigation conditions in the Murray Valley is to a great extent restricted to the top two feet. In addition, direct losses by evaporation to this depth will be considerable, and these two factors would account for the variation in soil moisture with depth. The water table may have some temporary effect on the surface moisture content, as rises of two and three feet were recorded immediately after irrigation on all three types. Although the table begins to recede immediately to the levels quoted earlier, there is probably a considerable augmentation of surface moisture content while the table is high.

As a rule, the moisture content was somewhat higher at the headland than the footland. The mean moisture contents for headland and footland samples were 12·6 per cent. and 12·2 per cent. respectively, with a significant difference of 0·2 per cent. This is generally true of furrow irrigation, and will only be upset when the grade of the irrigation run is not uniform. Such a change of grade occurs to a slight extent on the Barmera sandy loam plot.

APPENDIX I.

SOIL MOISTURE DETERMINATIONS.

	Depth. (Inches.)	Second Irrigation.				Third Irrigation.				Fourth Irrigation.				Fifth Irrigation.			
		Headland.		Footland.		Headland.		Footland.		Headland.		Footland.		Headland.		Footland.	
Barmera sandy loam	0–6	6·2	7·4	10·3	11·3	5·2	3·7	8·3	8·7	4·3	3·7	7·8	8·0	3·2	3·0	5·4	5·9
	6–12	7·3	8·5	11·1	11·8	5·8	4·3	11·6	9·9	4·1	3·0	9·4	9·6	3·3	4·0	6·6	7·1
	12–18	10·7	12·0	18·1	16·5	9·8	10·8	17·5	15·5	7·8	7·4	13·3	12·8	6·5	7·8	9·0	9·4
	18–24	14·8	16·0	18·1	19·0	16·3	18·2	17·6	16·8	11·1	13·1	14·5	14·4	11·3	13·3	9·1	9·3
	24–30	17·4	18·0	15·8	14·6	17·4	16·5	15·5	15·2	14·1	14·4	14·0	13·4	15·4	10·8	9·7	9·3
	30–36	15·7	16·7	15·3	11·8	15·6	15·6	15·7	14·8	14·0	14·6	13·8	13·6	13·9	14·3	10·1	9·3
Berri sandy loam	0–6	11·8	10·2	10·9	11·1	10·3	11·0	9·2	9·0	8·9	9·4	7·7	7·0	9·0	11·2	6·6	5·5
	6–12	12·7	13·1	11·0	11·0	14·1	13·8	10·5	10·2	10·2	11·6	9·1	9·0	12·1	13·2	7·2	6·9
	12–18	15·6	15·1	11·5	12·3	15·9	16·1	13·0	9·3	12·4	14·8	9·7	11·7	12·6	13·2	10·9	9·5
	18–24	15·7	16·7	14·6	14·5	16·9	15·3	16·6	17·8	14·2	14·0	14·8	14·6	13·9	12·7	13·8	13·4
	24–30	14·8	14·0	15·6	16·0	14·6	14·2	15·1	15·6	13·2	13·0	14·4	13·9	13·7	13·3	12·6	12·7
	30–36	13·2	13·4	15·0	14·6	14·5	15·3	13·5	16·1	13·9	13·1	14·6	14·8	16·1	14·6	12·5	12·7
Loveday sandy loam	0–6	14·6	13·8	8·4	8·3	10·8	12·9	5·8	8·1	11·2	10·7	6·0	6·4	8·9	8·2	6·8	6·6
	6–12	17·4	15·2	10·7	10·5	13·1	14·8	8·1	9·6	12·6	13·3	11·9	10·5	8·4	8·7	9·6	10·4
	12–18	19·1	19·3	14·7	13·7	17·4	16·5	15·0	16·6	14·9	14·3	12·7	14·7	9·2	8·9	11·9	10·7
	18–24	18·4	16·5	15·8	14·8	17·7	16·6	16·8	19·2	14·9	13·9	13·6	14·9	9·5	9·3	12·6	11·1
	24–30	17·0	19·1	12·9	12·0	16·5	15·5	16·8	16·2	14·4	14·0	13·8	14·5	10·0	9·5	11·6	11·8
	30–36	17·3	16·3	12·6	13·1	16·7	16·0	17·0	16·4	13·0	14·5	14·7	14·5	11·1	10·2	11·5	13·4

From an examination of the data given in Appendix I, it is apparent that the only serious approach to wilting point was in the top foot of the Barmera sandy loam. As will be seen from Table I, the surface of this plot is extremely light, and an approach to wilting point might be expected as the season progressed.

SUMMARY AND CONCLUSIONS.

1. The inter-irrigation fluctuations in soil moisture content were studied on three soil types in the Murray Valley irrigation areas in South Australia.

2. The fluctuations were limited to the top two feet, and the soil moisture depletions in this zone increased as the season advanced.

3. In all three cases the soil moisture content remained considerably above the permanent wilting percentage.

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A. L. TISDALL.

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The Australian Institute of Agricultural Science

NEW SOUTH WALES BRANCH.

The twelfth general meeting of the Branch was held on June 11 at Science House. The President (Mr. G. de V. Davis) occupied the chair. There was an attendance of 16 persons. The financial statement disclosed a credit of £18 17s. 7d. The report of the committee on population capacity was read and adopted; a special committee (Professor Watt, Messrs. Davis, Churchward, Southee, Savage and Moodie) was then elected to organize the work in N.S.W. The main business of the evening was an address by Miss Lorna Byrne, which was recounted in article form in last issue.

At the August meeting of the Branch, 14 members attended to hear the address on "Review of the Air Nitrogen Industry and its Contribution to the Range of Nitrogenous Fertilisers", by Mr. Robert A. Boyle, M.Sc. An article embodying the substance of this address will appear in the December issue of this Journal.

VICTORIAN BRANCH.

A general meeting of the Victorian Branch was held on June 11. Following an interesting discussion on "The Estimation of the Agricultural Potentialities of Victoria" led by Professor Wadham, a sub-committee of five members was appointed to report back to the Branch on suggested methods for studying the problem in this State.

SOUTH AUSTRALIAN BRANCH.

The second general meeting for 1937 was held at Adelaide on Friday, June 25. A welcome was extended to Dr. A. H. K. Petrie, who recently returned from a period of study leave spent abroad, and to Mr. B. E. Butler, formerly of the Western Australian Branch, who has been appointed to the Soils Division of the C.S.I.R. at the Waite Institute.

The secretary reported that requests had been received from Tasmania and Victoria for an outline of the methods that had been adopted in this State in connection with the recent survey of population capacity. A circular had been prepared and forwarded to all Branches. It is understood that active steps in the survey of their respective States are being taken in New South Wales, Victoria, Western Australia and Tasmania.

The main business took the form of a symposium under the title "Recent Advances in the Study of Plant Nutrition". Abstracts of papers contributed at the meeting are published in the main portion of this issue.

QUEENSLAND BRANCH.

At the July meeting, Messrs. Wells, Vallance and Von Steiglitz opened up a symposium on soil erosion. Soil erosion is perhaps more severe in coastal Queensland than elsewhere owing to the characteristically heavy, though sporadic, rains during the summer months. In some cotton growing districts, susceptibility to erosion is accentuated by existing cultural methods, and fundamental work at the Biloela Research Station has indicated the practicability of changed agronomic practices which, in conjunction with such physical means as check banks, specific row placement to ensure carry-off, and intercropping with strip pasture, should go a long way to solve the problem.

The soil chemist and soil physicist have as yet been unable to devise an accurate measure of soil susceptibility to erosion, and they perhaps can most usefully study the problem by checking the influence of cultural and cropping practices on soil behaviour.

WESTERN AUSTRALIAN BRANCH.

The annual meeting of the Branch was held on May 7, 1937. The annual report showed a Branch membership of 41 corporate and 10 student members. Mr. H. A. Pittman was elected president for the ensuing year; Dr. L. J. H. Teakle, vice-president; and Mr. R. P. Roberts, secretary-treasurer.

The idea of a population survey has received attention by the Branch, and a study has been made of the South Australian and New South Wales proposals. It has been decided that the first step in Western Australia should be a land utilization survey, and a sub-committee consisting of the Branch president (Mr. Pittman), Mr. Roberts, and Dr. Teakle has been appointed to direct the gathering of information through the available sources.

The address of the retiring president (Mr. G. K. Baron-Hay) dealt with "The importance of accurate agricultural records as a factor in the success of land development". The treatment was designedly of a speculative nature, and dealt largely with the scientific aspects of land settlement and development in Western Australia. The Institute of Agricultural Science was, the speaker stated, interested in the provision of a sound scientific background, based on investigation, for present and future agriculture, the maintenance of a competent staff of trained agriculturists and the establishment of public confidence in agricultural science. In the last 15 or 20 years, considerable progress in these directions had been made, and any future development would be based on the firm foundations of the accumulated evidence of experience and investigation.

It was considered that future expansion of agriculture and population in Western Australia would be largely in the higher rainfall areas of the south-west, where more intensive agriculture is possible. The wheat areas were unlikely to expand very much in the near future, and mechanisation probably would maintian the farm population at a fairly constant level, if not cause an actual decrease. In the dairying areas, however, the ratio of population to production appeared to be more constant, and development in this direction offered a means of absorbing population.

The importance of diversified agriculture, crop rotation, fertilisation and pasture improvement in stabilising the agricultural industry after the pioneering stages had been passed were mentioned. In this connection "agricultural research" was now popularly recognized as the means of furthering agricultural development, and the old catch-phrase cry of "practical experience" has had to yield to the newer concepts of a scientific age.

Current Notes and News

AGRICULTURAL SCIENCES CLUB, S.A.—MAY MEETING.

The second meeting of the Club for 1937 was held at the Waite Institute on May 27. The President, Mr. D. B. Adam, was in the chair. Four short papers were given; an account of these appears hereunder.

Mr. R. F. Williams spoke on "Plant Growth and Temperature". Growth rates expressed on a protein nitrogen basis were presented for two experiments conducted in the glasshouse—(*a*) Sudan grass grown in summer, (*b*) oats in winter. Except under conditions of luxury consumption of nitrogen, these growth rates showed a very close relationship to temperature; and temperature coefficients (Q_{10}) in the two experiments were approximately 2·0. This figure agrees with the temperature coefficient for carbon assimilation under high light intensities.

Using the protein content of the leaves as an index of the "protoplasmic" factor, the relative growth rate of the plant was analysed into the leaf weight ratio, the "protoplasmic" factor and the unit protein rate. Of these, only the latter was directly dependent upon temperature.

Mr. T. T. Colquhoun gave a paper on the "Probable Application of Root Amputation to the Take-all Problem". An experiment was described in which wheat roots were amputated at various times and in varying numbers. The results obtained were as follows: Tiller numbers and grain weights showed that early injury of the roots, particularly the seminal roots, considerably reduced yield and delayed maturity, whilst injury later also significantly decreased yield (but to a lesser extent) and induced early maturity. These results were compared with the effect of varying the time of inoculation of wheat plants with *Ophiobolus graminis*, and the results showed a close parallelism. The experiments threw some light on the contention that whiteheads were the result of late infection either by spores or mycelium; results suggest that infection must take place early in the life of the plant to cause severe depreciation in yield.

Mr. C. M. Donald dealt with "Strain Variation in Subterranean Clover". A range of selected subterranean clover types had been studied during 1935 and 1936. Yield and leafiness showed correlation with lateness of maturity, though significant differences were sometimes found between the yields of types of the same maturity group.

Inherent and environmental factors affecting the number of seeds produced, and therefore the persistence of the types under varying conditions, were discussed. The number of flowers is a function of lateness of maturity, while flower abortion is dependent on evaporation during the flowering period. Tallarook differs from all other types in that its seed setting shows no apparent dependence on climatic conditions.

Mr. T. H. Strong discussed "Some Aspects of Pasture Development on Kangaroo Island". An analysis was made of the difficulties that appear to have prevented the intensive agricultural development of this area. The soils were placed in two categories: (1) heavier soils responsive to superphosphate and fallowing, and (2) the poor ironstone soils and podsolised sands of the inner plateaux, ridges, and slopes, which cover the major portion of the island, and which do not respond significantly to fallow. In regard to the latter types, it was suggested that a rapid upward trend of fertility would follow heavy superphosphate application and intensive symbiotic nitrogen fixation. The low phosphate level, however, is naturally accompanied by a deficiency of essential microorganisms, and the introduction of effective strains of Rhizobia together with their stimulation by liberal phosphate fertilization, is necessary to secure economic legume establishment. The possible adaptability of subterranean clover and lucerne to large areas was discussed.

MELBOURNE UNIVERSITY AGRICULTURAL SOCIETY.

On May 20, Dr. W. J. Young, Associate Professor of Biochemistry at the University of Melbourne, addressed the Society on " Some Aspects of Agriculture in Other Lands ", with specific reference to Palestine. He described the primitive system of agriculture in existence there, and contrasted this with the up-to-date research work which is conducted in other spheres, such as the Department of Health. In addition, much advanced scientific research is being carried out by the Jewish Research Institute. Dr. Young considers the citrus industry to be the only paying one in Palestine, and predicts a large increase in production in the next ten years, although it is expected that the problem of marketing will then become rather acute. (Attendance, 55.)

The speaker on June 18 was Mr. O. H. Gepp, Agricultural Adviser to Nitrogen Fertilisers Ltd., who advanced some provocative theories with regard to the grass-clover balance of pastures. In a precis of his talk circulated to members before the meeting, Mr. Gepp quoted the finding of the New Zealand National Dairy Association, that the " Waikato taint " of butter appeared to be due to certain clovers at a particular stage of growth following warm damp conditions. It was suggested also that it is possible the safe degree of " cloveriness " in our pastures has been reached, or even overstepped. The question of suitable species of pasture plants for the 18 to 23 inch rainfall belt of Victoria was then raised, and the influence of differential grazing on the botanical composition of a pasture was illustrated on a moving picture film. The lengthy discussion which followed Mr. Gepp's talk indicated that the meeting considered the benefits derived from a clovery pasture outweighed the possible disadvantages. (Attendance, 62.)

The State Superintendent of Dairying, Mr. J. M. Kerr, addressed the Society on July 9. His subject was " The Scrub Bull and Methods for his Elimination ". Mr. Kerr criticised the various breed societies, indicating that although they were useful for recording lineage, and so-called pure-bred bulls were most likely to confer a sound constitution on their offspring, no mention was made in the herd book of the improvement in milk yield and test that one might expect. In fact, many registered bulls had lowered considerably the average butter-fat production of their herds. It was suggested that, in future, admission to a dairy-breed herd book should necessitate a certain standard of butter-fat production and milk yield, which meant not the elimination of breed societies but rather their co-operation with those bodies best able to supply information with regard to milk and butter-fat performances of dams and daughters. (Attendance, 50.)

On July 30, Mr. J. N. Barrett, a Melbourne graduate in agriculture who has been farming at Narrabri, N.S.W., for the past 12 years, addressed a record meeting of 93 members and friends. His subject was " Agriculture and the Machine ", and he showed a movie film depicting recent developments in agricultural machinery in America. Mr. Barrett then gave an interesting illustrated account of the progress on his Narrabri property, particularly from the standpoint of tractor farming and the introduction of new farm machinery.

Social News. The annual " At Home " of the M.U.A.S. and the A.I.A.S. was held in the School of Agriculture on July 23. There was an attendance of 110 members and friends. As usual, the profits (£9) will be used to provide additional books for the Faculty library.

THE SPECTROGRAPH IN RELATION TO AGRICULTURAL PROBLEMS.

A paper on this subject was presented by Mr. A. C. Oertel at the July meeting of the Agricultural Sciences Club, S.A. The speaker described the principles on which the spectrograph and type of spectrographic analysis employed at the Waite Institute are based, and exhibited photographic plates on which images due to differing wave-lengths from soils and samples of plant ash had been recorded.

In the analysis of agricultural samples, electrodes of graphite are employed ; one of these is pointed, the other bored to provide a cavity 2 mm. in diameter and 2 mm. in depth. A sample is placed in this cavity and the arc struck ; light emitted by the arc contains radiations from the vapour of the sample, and these are brought by means of a lens and two prisms to a photographic plate, which in the spectrograph replaces the movable eye-piece of the ordinary spectroscope. Each line recorded in the spectrum corresponds to a definite wave-length of light, which in turn is linked with a particular element. The arc can only excite metallic elements and a few metalloids ; non-metals are not excited.

The photographic plate forms a permanent record of the spectrum emitted by each sample, and thus is of value in providing evidence of the presence or absence of elements not considered important at the time of analysis, but on which information may be required at some future date. Although the method described is a qualitative one, in general the intensity of the lines depends on concentration. In the analysis by ultimate rays, it is possible to work at a speed of approximately one minute per element.

In the case of diseases suspected as being due to the deficiency of an unknown element, evidence is provided very rapidly by a comparison of the spectra from the ash of healthy and diseased plants. Examples were cited of deficient beets in which both potash deficiency and manganese excess were found to be characteristic of the abnormal beets. The differentiation of these two possible causes then became a matter for field investigation.

A further example in the case of " sick " pine trees showed that the silver content of needles decreased as the pines became less healthy. Although proof of causality is necessary, this finding is obviously highly suggestive. The accuracy of the spectrographic method was said to be of the order of ten per cent. in the case of the arc, and approximately three per cent. with an electric spark as the source of light.

Discussion of this interesting paper stressed the great value of the method in rapidly determining the elements likely to be causal, and in providing a cogent guide to field experimentation.

BIOLOGICAL ASPECT OF THE GROWTH OF ANIMAL POPULATIONS.

In introducing a discussion on this subject at the July meeting of the Agricultural Sciences Club, S.A., Dr. J. Davidson stated that interest in the decline of human populations rendered the subject topical. Previous work had shown that the growth of a population followed a definite course, conditioned by two primary factors, birth rate and death rate. It was also influenced by biotic and abiotic factors of the environment. A species could not go on increasing indefinitely, owing to the limits of the biosphere or area inhabited. In nature, a species will tend to increase in numbers to a particular density where food and the physical environment permit, provided it can withstand the stress of competition.

During recent years, certain mathematicians have been attempting to develop mathematical expressions for the factors involved in what may be described as " the struggle for existence ". Biologists have been trying to obtain quantitative expressions for these factors. In this respect the work of Raymond Pearl and his school on the application of the " logistic curve "—$Y=d+\frac{K}{1+e^{a+bx}}$—to the growth of populations, has given a stimulus to this work. The logistic curve gives an empirical picture of the integrated effects of the inherent and environmental forces acting on the growth of a population. Departures from the logistic curve are due to changes in the stress of the environment ; fluctuations about the asymptotic density are due to changes in the environmental forces acting on the individuals comprising the population. It is evident that quantitative studies on these matters are essential to the future development of zoology. Similar principles are also applicable to the study of human populations and of growth in the numbers of animals used in the pastoral industry, as for instance, sheep.

In the case of human populations, however, man can condition his environment and prepare for future eventualities by the exercise of " mind ". He can also set up artificial conditions, which may greatly affect the population of a given area. It would seem that, with widespread education and the rapid development of applied science during the last eighty years or so, there is a lag in adjustment to the new psychological outlook which has developed. This has a significant bearing on the present tendency to a decline in human populations.

In the discussion which followed, the essential differences between natural populations and human populations were stressed, particularly in regard to the products of the mind factor, as exemplified by the rise of industrial conditions, immigration policies, the emancipation of women, education and planning for the future. Thanks were expressed to Dr. Davidson for opening a subject of widespread interest.

BREEDING RUST-RESISTANT WHEATS IN N.S.W.

Mr. H. Wenholz, Director of Plant Breeding in the N.S.W. Department of Agriculture, in the course of an address to the State Conference of the Agricultural Bureau in July, said that although farmers in the north-west may be safe from mild epidemics of wheat stem rust when the varieties Ford and Geeralying were grown, both these wheats have been observed to be badly damaged by rust under the higher temperatures of more severe epidemic conditions, and plant breeders of the Department were therefore not content to allow these varieties to represent the highest degree of stem rust resistance attainable in evolving new wheats. The wheat growing countries of the world had consequently been combed for varieties with a higher resistance to stem rust than Ford. Some such wheats have been obtained from northern U.S.A. and Canada, where the rust problem is also often acute, but in seeking such wheats from other countries the British Protectorate of Kenya Colony was discovered to be growing wheat in elevated districts in the tropics. It was thought that under such conditions rust should surely occur, and that wheat growing in that Colony must be well nigh impossible if resistant varieties were not being grown.

The introduction of varieties of wheat from that country proved this supposition to be correct, for these Kenya wheats have now been subjected for several years to artificially created epidemics of great severity, and it has not been possible to produce a particle of stem rust on them when even Ford was badly affected. Now, it has been too much to expect that these Kenya wheats would also be suitable from other standpoints for Australian conditions, and it was found that they mostly had too weak a straw or were susceptible to flag smut or had other defects which rendered them unsuitable for immediate cultivation in N.S.W. Mr. S. L. Macindoe, Plant Breeder of the Department, who is in charge of the work of breeding wheats suitable for the north-western slopes, soon had these Kenya wheats crossed with Australian varieties, and out of these crosses some new varieties are now being developed which have all the immunity to stem rust of the original Kenya parents, combined with the good agronomic characters of Australian wheats. Within a year or two now, it is hoped to be able to distribute seed to north-western wheat growers of one of these crossbreds, viz. Kenya × Florence × Dundee.

LATE SIR CHARLES SAUNDERS.

Sir Charles Saunders, the famous Canadian plant breeder, who selected Marquis wheat, died in July. Marquis actually originated from a cross made in 1892 by a brother of Sir Charles, when the two young men were working under the supervision of their father, Dr. William Saunders, the first director of the Canadian Department of Agriculture. The cross comprised an early maturing type from India, termed Hard Red Calcutta, and the then leading Canadian wheat, Red Fife.

The progeny of this cross was still quite composite in 1903, when Sir Charles (then Dr.) Saunders began the systematic analysis of all promising material which came into his hands. Many individual plants were selected out of the mixture from the cross, and their succeeding progeny were subjected to critical study in " separate cultures " for some years.

The introduction of the variety into commercial cultivation in 1909 completely overshadowed in importance any other single event, marking a new epoch in the agricultural and industrial life of the Dominion. Within ten years from its launching, it is credited with having occupied not less than 90 per cent. of all the spring wheat area in Canada. Even in the United States it became the most generally grown spring wheat. Marquis is estimated to have increased the Canadian wheat harvest by 75 million bushels a year.

LATE Mr. FRANK MADDOX.

The passing in July last of Mr. Frank Maddox at the age of 82 years, removed one who made a number of contributions to our knowledge of wheat diseases. He it was who first demonstrated that loose smut of wheat originated as a result of infection at flowering time, and his first experiments in this connection were made in Tasmania in 1892, the results being published in 1895. All standard works on plant pathology make reference to this important contribution.

Frank Maddox was born at Launceston in 1856, and was educated at the Launceston Church of England Grammar School. He entered on a seafaring life but later took up farming. The Tasmanian Department of Agriculture became interested in the various experiments he had instituted on his property, and in 1893 accepted his suggestion for the establishment of farmers' experiment plots which are believed to have been the first of their kind in Australia. The tests included cultural and manurial experiments, variety and feeding trials, and bunt fungicide tests.

Frank Maddox was a keen observer and patient investigator. His achievements were all the more meritorious in view of the personal sacrifices he made to obtain the limited facilities available at the time.

INVENTION OF THE STRIPPER.

At the June meeting of the W.A. Branch of the Institute, Dr. G. L. Sutton, Director of Agriculture, delivered an address on the circumstances surrounding the production of the Australian stripper, a machine which has meant so much to the wheat industry in Australia, and the world. The growth of the area under wheat in South Australia in the early forties had outstripped the supply of agricultural labour, and there was considerable need (which was backed by a public urge) for the invention of a harvesting machine to economise labour.

In September, 1843, sixteen designs and models of proposed harvesting machines were exhibited in Adelaide in competition for a prize offered by the Corn Exchange Committee. Of these models, only one involved a new principle in departing from the idea of the cutters of the reaping machine. This was the exhibit of Mr. J. W. Bull of Mt. Barker, who conceived the idea of the comb and beaters.

Although not a competitor at the exhibition, Mr. John Ridley, of Adelaide, at the same time, was engaged on the construction of a harvesting machine which was equipped with prongs and cutters to collect and detach the heads of grain as well as thresh and winnow the crop. On trial in October, 1843, this machine proved a failure, but, undeterred, Ridley constructed a second machine embodying the principle of the comb and beaters, which had been exhibited by Bull at the public meeting of the Corn Exchange Committee in Adelaide on September 19, 1843. This second machine was tried in the field on November

14, 1843, and proved successful. It is the original of successful harvesting machinery which has meant so much to Australia.

There are many who claim that John Ridley is the inventor of the principle of the Australian stripper, and who deny Bull's claim. Dr. Sutton has assiduously studied the letters and other literature published in connection with the Bull-Ridley controversy in the matter; he has carefully reviewed the contemporary newspaper reports in the *South Australian Register*, *The Adelaide Observer* and *Southern Australian*, and after a critical review, has concluded that John Wrathall Bull was the inventor of the principle of the comb and beaters, while John Ridley successfully incorporated this fundamental in the first "Australian stripper" made by him. Both Bull and Ridley are therefore entitled to share jointly in the honour merited by such service.

ORIGIN OF THE REAPING MACHINE.

At the time the centenary of Cyrus McCormick's reaper was celebrated, an article appeared in *Suaga* (Bulletin of the Sydney University Agric. Graduates' Assoc., September, 1931) pointing out the main features of McCormick's machine, and drawing attention to the fact that the really first successful reaper was that invented some years earlier by Rev. Patrick Bell of Fifeshire.

Of interest is a statement on this subject contributed to the January 30 issue of *Nature* (1937) by James Hendrick, of Aberdeen University, who also points out that Cyrus McCormick was not the inventor of the reaping machine. The first really practical machine, he states, was made by the Rev. Patrick Bell in 1828, whilst a divinity student at the University of St. Andrews. A full account of this machine was published in the *Quarterly Journal of Agriculture*, in 1828.

It has been claimed that McCormick made his first reaper in 1831, but there is no proof that he manufactured any machine until several years later. Bell's original machine, which was in use for many years, is now in the Science Museum at South Kensington.

Though Bell never patented his machine, Mr. Hendrick declares, McCormick took out patents in 1834, but by that time several of Bell's machines had appeared in America. Bell considered it his duty to present the idea to the agriculturalists without retaining any patent rights, and consequently many imitations were made. All the main features of Bell's machine appeared in McCormick's early types.

RANSON MORTLOCK LABORATORY, WAITE RESEARCH INSTITUTE.

A note describing progress with the erection of this building appeared in the last issue of the Journal. The following objects were placed beneath the foundation stone, which was laid on May 3, 1937, by Mrs. Rosye F. Mortlock, in the presence of the Chancellor, the Vice-Chancellor, members of the University Council and some two hundred visitors:

1. A representative collection of the seeds of 100 indigenous forage plants which had been gathered in the arid and semi-arid pastoral regions, 1936-37.

2. A collection of soil samples representing the non-eroded pastoral areas of the north-eastern pastoral region of South Australia.

3. Copy of the *Advertiser*, May 3, 1937.

SOIL EROSION INVESTIGATIONS AT PALLAMANA, S.A.

Preliminary experimental work in connection with the problems of soil erosion and pasture regeneration has been commenced on the property of Mr. R. Laidlaw Davidson at Pallamana, S.A., a mallee centre, approximately 50 miles from Adelaide, and receiving

an average annual rainfall of 12 inches. A meteorological station has been established in conjunction with the local post office ; this provides for maximum, minimum, wet and dry bulb daily temperatures. In view of the increasing importance of evaporation in Australian biological and agricultural work, a standard evaporimeter has also been installed, in addition to the standard type of rain gauge.

Two types of field experiment have been commenced. One involves the testing of numerous indigenous and exotic plants likely to be of value for pasture regeneration ; the other constitutes a preliminary attempt to establish permanent pasture on a local area of drift sand.

WIRELESS TALKS BY STAFF OF WAITE INSTITUTE.

An arrangement was recently made between National Stations 5CL, 5CK and the University of Adelaide, by which an ordered series of weekly wireless talks on " Science in Agriculture " has been given by members of the staff of the Waite Institute. In this series an attempt was made to provide a more or less continuous sequence of material, each individual talk tending to lead up to the one following. The opening talk was given by Professor A. E. V. Richardson on June 30, and was entitled " The Meaning and Value of Agricultural Science ". The remaining titles were as follow : " The Soil in Agriculture " (J. K. Taylor), " The Scientific Development of Agriculture " and " The Building of Fertility " (H. C. Trumble), " The Requirements of Crop Plants " (A. E. V. Richardson), " The Balance of Life in Plants " and " The Control of Disease in Crop Plants " (D. B. Adam), " Insects in Relation to Agriculture—(1) Occurrence, and (2) Control " (J. Davidson), " Some Deficiencies in Australian Soils " and " Some Difficult Problems in the Management of Soils " (J. A. Prescott), " Soil Surveys in Relation to Land Utilization " (J. K. Taylor).

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Book Reviews

Introduction to Research on Plant Diseases, by A. J. Riker, Ph.D., and Regina S. Riker, Ph.D.

(Pp. 117, with 8 tables and 20 figures. Planographed by John S. Swift Co., Inc., St. Louis, Chicago, New York and Indianapolis. 1936. Price, 2·65 dollars.)

When it was announced last year that the Rikers were preparing a guide to research on plant diseases, the anticipation was that a long-felt need would be met for both the research student and the more experienced worker. The product of their labours, based on many years of teaching and research, is fully up to expectations and is a worthy addition to phytopathological works.

To the raw graduate, untrained in investigational procedure, this book will make a great appeal, and the section on " Preliminary Considerations " warrants careful reading—if for no other reason than that it will implant in the reader's mind an outlook essential for success. Indeed there is scarcely a page of the book that can be passed over by the research student who aims at securing a broad view of investigational methods generally. Details are presented for forming a proper foundation to the research problem and for literature studies, while laboratory equipment and general methods receive due attention. Formulæ of selected culture media and differential media are given, and colorimetric and electrometric methods of measuring hydrogen ions are considered in a separate chapter. The section on " Isolation, Culture and Inoculation " proves most useful for the practical details applicable to many a research problem ; of special value are the methods detailed for isolation of single cells of fungous spores and bacterial cells, and the discussion concerning various aspects of bacteria in culture. Virus diseases are treated rather briefly, the treatment being mainly of the technique developed for purposes of transmission and study of properties of the virus. A chapter is devoted to the preparation of microscopic mounts, the paraffin method, staining, and means of demonstrating fungi and bacteria in host tissues.

The section on " Epidemiology, Environment and Control " is useful for introductory purposes, but frequent consultation of references will be found necessary by the researcher. It is unfortunate that in the discussion on epidemiology no mention is made of recent concepts in climatology. The applicability of statistical methods is dealt with, and in this chapter the authors have received great assistance from Dr. C. H. Goulden. The concluding chapters treat of miscellaneous subjects (preservatives for museum specimens, photography, preparation of manuscripts for publication, laboratory exercise topics) and provide very useful information on several unrelated matters. The value of the book is enhanced by the bibliography given for each chapter.

The work cannot fail to be of value also to teachers, while to the experienced researcher it will prove most useful for reference. One regrettable feature—the book is planographed, not printed, and therefore tiring to the eyes with close study.

H. J. Hynes.

The Plant Diseases of Great Britain, by G. C. Ainsworth, B.Sc., Ph.D.

(Pp. xii+273. London: Chapman & Hall, Ltd. 1937. Price, 15/- nett.)

This book represents an attempt to list the principal plant diseases occurring in Great Britain and to provide the key bibliographic references to most of them. The bibliography is annotated, drawing attention to the salient features discussed in the various papers or books quoted. The references are by no means complete, but the attempt has been rather to list the principal papers published on plant diseases in Great Britain and to include just selected foreign papers. The arrangement of the various sections is convenient, and even without access to the extensive index (author, host, parasite) one can readily turn to a particular host or group of hosts for the diseases and pertinent references.

The book will fulfil its purpose in acquainting workers both at home and abroad with what are the principal plant diseases in Great Britain, and should prove serviceable to quarantine authorities in foreign countries. But its chief value lies in enabling workers quickly to ascertain where descriptions of symptoms, causal agents, control measures, etc., can be found in the literature, particularly in the case of those diseases not dealt with in standard text books.

As Dr. Ainsworth himself acknowledges, the book is incomplete in that not all plant diseases in Great Britain are listed, and only selected papers are included in the bibliography. Nevertheless, the production is most acceptable.

H. J. Hynes.

A Practical Course in Agricultural Chemistry, by Frank Knowles, F.I.C., and J. Elphin Watkin, B.Sc., Ph.D.

(Pp. viii+188 with 21 figures. London: MacMillan & Co., Ltd. 1937. Price, 10/- nett.)

This book is intended for readers who have a general knowledge of theoretical and practical chemistry. A glance at the contents shows seven chapters dealing in a practical manner with Soils, Fertilizers and Manures, Plant and Animal Biochemistry, Feeding Stuffs, Dairy Products, Chemical Examination of Water, Insecticides and Fungicides. The majority of the quantitative methods described are those that experience has shown to be reliable. A few of the methods are, however, open to criticism. The method for the determination of water-soluble arsenic in lead arsenate falls into this category. The operator is directed to mix 10 grammes of lead arsenate powder with one litre of recently boiled water, and after certain treatment to filter through a dry filter paper. It is very doubtful whether this method will give a correct estimate of the amount of soluble arsenic likely to be present in lead arsenate sprays, as the concentrations used in the chemical method are much higher than those used in field operations. The method used for filtering the lead arsenate suspension is also time-consuming and inefficient. The substitution of some form of unglazed porcelain candle and filter pump for the filter paper would be a considerable improvement.

Again, it is very doubtful whether a student can accurately determine the sodium chloride in butter by ashing the sample and extracting the sodium chloride with water.

The section on Hydrogen-ion Concentration or pH value (colorimetric method) is rather short, and its usefulness could be greatly extended by the addition of instructions and methods for the preparation of trustworthy buffer solutions.

In spite of these minor defects, the book fills a long felt want, and should prove very useful to teachers, and especially to students of universities and colleges preparing for a degree in pure science or agricultural science. It is well produced, and is remarkably free from typographical errors. It is supplied with a full and useful index, but one notes with regret the absence of any form of bibliography.

E. GRIFFITHS.

An Introduction to the Scientific Study of the Soil, by Norman M. Comber, D.Sc., A.R.C.S., F.I.C.

(Third edition. Pp. vii+206 with 25 figures. London: Edward Arnold & Co. 1936. Price, 7/6.)

This book is intended merely as an introduction to the study of soil science and, as such, specifically for students. It is certainly no more, and could hardly be less !

One almost gasps at the brevity under such headings as Base Exchange and Soil Colloids. Subjects like Soil Microbiology and Modern Experimental Technique, although no doubt receiving their due proportion of mention, suffer severely under such abbreviation. That most of the summaries arrived at are so brief and appear, in some cases, so unsatisfactory is not so much a reflection upon the author as upon the progress of the science itself.

Norman M. Comber reveals himself throughout this concise epitome sufficiently to lend, at times, a certain warmth to the reading. He has dared to introduce into this edition an unorthodox view of his, on the subject of the time-honoured value of nitrifying bacteria in the soil, which has appeared previously in a journal. He expresses mildly some impatience with the work along Russian pedological lines.

The author has added to the value of his work, as an introduction for students, by listing in the last chapter of the book a number of what one terms " standard " works on soil science. These are followed by brief descriptions of the nature of the contents of journals, abstracts and résumés which deal with the subject, and, finally, there is a bibliography of papers conveniently arranged under suitable headings.

A particularly easy and inviting book on the subject to read, and one that should be of particular value to specialists in other branches of agricultural science and to extension workers in general, with the necessary knowledge of elementary chemistry, either of whom might desire to acquire a nodding acquaintance with the subject under treatment.

ROBERT A. BOYLE.

Personal Notes

CANBERRA, F.C.T.

Dr. F. G. Holdaway has accepted the dual position of Associate Professor of Entomology at the University of Hawaii, and Chief Entomologist to the Research Station of Hawaii. He will leave Sydney on September 17. Dr. Holdaway graduated from the University of Queensland in 1923, and entered the Queensland Department of Agriculture and Stock. In 1925-26 he was assistant lecturer in zoology in the University of Adelaide, and then accepted a C.S.I.R. studentship tenable at Cornell and Minnesota. Joining the C.S.I.R. staff, he conducted investigations on blowflies in Europe and Australia from 1928 to 1932, when he changed over to termite work. Dr. Holdaway has taken an active interest in Institute affairs, both in its general programme and in constitutional matters.

Dr. B. T. Dickson presided, and Mr. A. V. Hill acted as secretary at a conference of tobacco officers, Commonwealth and State, held in Melbourne on July 13th to 15th, 1937.

NEW SOUTH WALES.

A dinner at the Hotel Metropole was tendered by the N.S.W. Branch to Mr. E. T. Edwards on July 30, prior to his departure for U.S.A. as Commonwealth Fund Service Fellow. Eulogistic references were made by Professor Watt and others to Mr. Edwards' services to the Institute as first secretary of the N.S.W. Branch and as Business Manager of the Journal. The Federal Executive Committee had previously signified its appreciation of his work by presenting him with an inscribed fountain pen.

Mr. N. S. Noble has been appointed Business Manager of the Journal, in succession to Mr. E. T. Edwards. He was the first treasurer of the N.S.W. Branch.

Mr. C. J. Magee has returned from his six weeks' trip to Fiji, where he investigated, amongst other matters, the possibility of introducing varieties of banana resistant or immune to bunchy top.

Mr. R. D. Wilson, W. and E. Hall Fellow, has returned from U.S.A. and England, where he continued his researches into diseases of vegetable crops. Whilst at Wisconsin he secured the M.Sc. degree, having previously graduated M.Sc.Agr. at Sydney.

Mr. H. V. Rees has been appointed Dairy Bacteriologist to the Tasmanian Department of Agriculture, and is at present inquiring into various experimental techniques at the Biological Branch of the N.S.W. Department of Agriculture.

Mr. L. S. Cayzer has been appointed Teacher of Science of Breadmaking (part time) at the Sydney Technical College.

VICTORIA.

Mr. C. P. Goulding recently resigned as manager of the Rutherglen Experiment Farm to take up the position of manager of " Blackwood " Station, Penshurst, Victoria. His object there is to develop the carrying capacity of this 13,000-acre property.

Mr. A. N. Waite has also resigned from the Department of Agriculture, and accepted a position with Barrett Bros. and Burston & Co. Pty. Ltd., a local firm of maltsters.

Dr. H. C. Forster will return to Victoria towards the end of September, after his tour through England and the Continent under the auspices of a Commonwealth Fund Service Fellowship.

Miss Jean Robertson has accepted a position with Australian Paper Manufacturers, Ltd.

Mr. P. A. Reid, a Melbourne graduate on the land at Scone, N.S.W., visited Melbourne recently on his way to Colombo.

Mr. F. de Castella, President of the Wine and Food Society of Victoria, has been given the rank of Officer de Merite Agricole by the French Government.

SOUTH AUSTRALIA.

Professor A. E. V. Richardson visited the northern pastoral areas of South Australia with other members of the State Soil Erosion Committee between July 9 and 18.

Professor J. A. Prescott recently returned from a six weeks' visit to various portions of northern and north-eastern Australia, including as centres Noonkanbah and Argyle in the Kimberleys, and Darwin, Daly River and Katherine in the Northern Territory. Adoption of air travel between working centres, with motor transport in the areas visited, enabled a comprehensive tour to be made in a comparatively short space of time. Professor Prescott was assisted in his investigations by the Superintendent of Agriculture at Darwin, Mr. H. K. C. Mair.

Dr. A. H. K. Petrie returned to the Waite Institute on June 5, following a period of study leave abroad. Most of his time was spent at the Botany School at Cambridge University ; in addition, he visited Germany, Austria and Holland, in connection with the tobacco investigations being conducted in co-operation with the C.S.I.R.

Mr. J. R. Goode has been appointed Assistant Agrostologist in connection with investigations of pasture management being carried out at the Waite Institute under Dr. J. G. Davies.

Mr. R. L. Crocker returned on July 28 from an expedition, led by Dr. C. T. Madigan, into Central Australia for the purpose of examining the alunite deposits in the Tarlton Ranges.

Mr. T. O. Mitchell, formerly Advisory Officer of Nitrogen Fertilisers Ltd., at Adelaide, has been transferred to the Pesticides and Fungicides Department of Imperial Chemical Industries Ltd., Melbourne.

Messrs. O. H. Gepp, of Nitrogen Fertilisers Ltd., and A. J. Vasey, of the Division of Animal Health, C.I.S.R., and Hon. Secretary of the Institute, both visited Adelaide in July.

Mr. E. A. Cornish has been granted study leave by the University of Adelaide to enable him to work for a year at the University of London under Professor R. A. Fisher.

OTHER STATES.

Dr. Hugh Gordon, of the University of Edinburgh, who has recently been appointed Lecturer in Botany at the University of Tasmania, was accorded a welcome on June 24 at the Launceston office of the Department of Agriculture.

A meeting of the Hobart Sub-branch of the Institute was held at the residence of the Director of Agriculture (Mr. F. E. Ward) on June 18, at which Mr. D. Martin gave an address on " Apple Investigations in Tasmania ".

Mr. W. G. Wells, Director of Cotton Culture in the Queensland Department, departed for the United States in July on a seven months' period of investigation abroad.

Following the retirement of Dr. G. L. Sutton from the directorship of agriculture in Western Australia, the Government has decided to reorganize the Department, so that an under secretary will be the administrative head. The present secretary, Mr. L. Jones, has been named as the appointee.